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IBM System/38

Functional Reference Manual—Volume 2



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This major revision makes obsolete GA21-9800-0. Some of the information in this manual was previously documented in the IBM System/38 Functional Reference Manual, GA21-9331. See About This Manual for a summary of the information contained in this manual.

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ABOUT THIS MANUAL**PURPOSE OF THIS MANUAL**

This publication provides information that relates to the System/38 machine interface instruction set. The information in this manual can be used to code the machine interface instructions that are documented in the IBM System/38 Functional Reference Manual-Volume 1, GA21-9331. It provides reference information for the systems engineer and the program support customer engineer.

Information about the following subjects is provided in this manual:

- Machine initialization
- Source/sink configuration
- Local source/sink devices
- Communications
- Load/dump object management
- Source/sink events and exceptions
- Source/sink recovery



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0.0 RESERVED

1.0 RESERVED

2.0 MACHINE INITIALIZATION

Machine Initialization is the method used to initialize the functions required to support the MI (Machine Interface) and initiate an MI process. Refer to the MI architecture for further definitions of the functions described in this section.

The machine initialization function:

- Provides a consistent well defined interface for initialization of the machine that can be used for all System/38 machines.
- Provides a means to allow the machine to automatically initialize itself without communicating with the machine console.
- Provides a means to create the initial process from user provided data.

2.1 MACHINE INITIALIZATION TERMS AND DEFINITIONS

The following are the definitions of terms associated with the machine initialization function:

- Power On is the activation of the machine power supply via a manual power on or an automatic power on (Auto-IMPL). Power On, whether manual or automatic, always performs an implicit initiation of machine processing.
- IMPL/IMPLA sequences are the functions performed by the machine that are necessary to initiate machine processing. IMPL/IMPLA always refers to the using of internal storage as the data source for the initial loading of microcode.
- IMPL/IMPLA Halt causes the machine to enter the check stop state as the result of a machine malfunction while the IMPL/IMPLA sequence is executing.
- Machine to programming transition is the mechanism whereby a machine function implicitly creates an initial process as the final function of the machine initialization sequence. The setting of the second CE/Operator panel rotary switch is used to determine whether an AIPL or IPL is to be performed.
- AIPL is an alternate Initial Process Load via the loading of MI source data from external storage data media (load/dump).
- IPL is the Initial Process Load via the loading of MI encapsulated data from the machine internal storage.

2.2 MACHINE INITIALIZATION OVERVIEW

The machine provides through the CE/operator panel the ability to perform the functions of installing and initiating a process independent of the existence of an initiated process.

Installation of a process onto System/38 is done via the Alternate Initial Process Load (AIPL) function described in section 2.3.1. AIPL always performs installation of MI source data and initialization of a process as one operation.

Initialization of a process by the machine can also be done independent of the AIPL function. In this instance the objects required to initialize a process exist within the machine as encapsulated objects. This function is called Initial Process Load (IPL) and is described in section 2.3.2.

The machine initialization function also provides a means for notifying the MI about the status of the machine after the machine has been initialized. This information resides in the machine as a machine attribute called the Machine Initialization Status Record (MISR).

The machine initialization function is divided into Initial Microcode Program Load (IMPL) or Initial Microcode Program Load Abbreviated (IMPLA), and the machine to programming transition (IPL/AIPL). The IMPL/IMPLA machine initialization function is defined in Section 2.5.

2.3 MACHINE TO PROGRAMMING TRANSITION

The machine to programming transition function provides a means for the machine to initiate a process independent of the execution of the INITIATE PROCESS instruction. This function is performed as the final part of the machine initialization function. The process that is initiated is defined from the MI data that exists in one of the following forms:

- MI Source Data (AIPL)
- MI Encapsulated Data (IPL)

2.3.1 AIPL MI SOURCE DATA

The AIPL MI source data is loaded from the primary load/dump device and must exist as in character scalar format. The character scalar exists on the load/dump device as either a character scalar (data interchange) or space object dumped by load/dump.

A detailed description of the character scalar is shown in section 2.5.1.3.1.

The MI source data required to perform an AIPL consist of the following MI templates.

- User Profile Template
- Program Template
- Process Definition Template

The templates are encapsulated into the corresponding MI objects such that the final product is an initiatable process. If any abnormal condition occurs while encapsulating the AIPL templates the machine to programming transition function terminates. Termination causes an IMPL/IMPLA halt to occur.

2.3.1.1 AIPL User Profile Template

The AIPL user profile template has the same format as the user profile template defined in section 6.2.6 of Pacific MI Architecture - Volume II. Since the user profile created does not have a owning user profile created by the machine, it owns itself. If a user profile exists on the machine with the same name as that defined on the user profile template, the existing user profile will be used. If the existing user profile is damaged, it will be destroyed. A new user profile is created from the AIPL user profile template. If the machine context is damaged, it will be reinitialized if a new user profile is created. Addressability through the machine context to all other objects contained in the machine context will be destroyed. It should be noted that in this instance the objects owned by the destroyed user profile are not assigned to the created user profile. The MISR will contain an indication that a new user profile was created because of damage to an existing (duplicate) user profile. Since addressability to the created user profile is also placed in the machine context, the name of the user profile can also be obtained via the MATERIALIZE CONTEXT instruction. In this instance, the MI user must know the name of all the user profiles in the machine context so that he can selectively determine the user profile created by the machine.

2.3.1.2 AIPL Program Template

The program template of the AIPL source data defines the program that receives control when the initial process is initiated. The machine will encapsulate only one program per AIPL.

2.3.1.3 AIPL Process Definition Template

The AIPL process template source data defines the process to be initiated. The process definition template should not contain any resolved system pointers. The machine fills in the system pointer to the user profile created from the AIPL user profile template and the system pointer to the problem program created from the AIPL program template. The process control attribute (process type) of the AIPL process definition template should be set to an independent process.

All space objects required by the MI architecture for the initiation of a process are created by the machine to programming transition function. The process automatic storage area, process static storage area, and process control space are created with attributes temporary, extendable, no associated space. They are assigned object names and subtypes of binary zero. System pointers to these spaces may be obtained from the MISR with the MATERIALIZE MACHINE ATTRIBUTES instruction.

2.3.2 IPL MI ENCAPSULATED DATA

The IPL function performs initiation of a process from data residing in the machine as encapsulated data. The data is a process definition template for the INITIATE PROCESS instruction. This process definition template is a machine attribute called the Initial Process Definition Template. The IPL function uses the process definition template to initiate the initial process. The process control space, process static storage area, and process automatic storage area for the IPL process are created by the machine. System pointers to the spaces are saved in the MISR and may be materialized via the MATERIALIZE MACHINE ATTRIBUTE for the MISR.

2.4 AIPL/IPL MACHINE ATTRIBUTES

The machine initialization machine attributes provide a means for saving, within the machine, information required to perform the machine to programming function. The machine initialization machine attributes also provides a means of collecting the machine status associated with events that occurred before a process is initiated. The attributes are called Initial Process Definition Template and Machine Initialization Status Record.

2.4.1 INITIAL PROCESS DEFINITION TEMPLATE MACHINE ATTRIBUTE

The Initial Process Definition Template Machine Attribute provides a means for the MI user to save within the machine those parameters required for the machine to perform an IPL. The Initial Process

Definition Template is saved within the machine via the MODIFY MACHINE ATTRIBUTE instruction.

A program may materialize the Initial Process Definition Template via the MATERIALIZE MACHINE ATTRIBUTE instruction. MI Architecture describes the parameters required to materialize the initial process definition template machine attribute.

2.4.2 MACHINE INITIALIZATION STATUS RECORD MACHINE ATTRIBUTE

The machine initialization status record is a machine attribute that provides a means of passing to a program the status of the machine as collected during machine initialization. The status record contains the machine event related information that is normally passed to the MI via MI events after AIPL or IPL. A program may materialize the machine initialization status record at any time. The status record is created by the machine. A process may reset the status record via the MODIFY MACHINE ATTRIBUTE instruction.

2.5 MACHINE PROCESSING ACTIVATION

Machine processing can be initiated either manually by the Power-On or Load pushbuttons on the CE panel, or automatically by the optional auto-IMPL feature. The following paragraphs address the normal methods of manually initiating machine processing.

2.5.1 OPERATOR INITIATED MACHINE PROCESSING

The operator has at his disposal three means of initiating machine processing. The operator can initiate either an initial microprogram load (IMPL), initial microprogram load abbreviated (IMPLA), or an alternate initial microcode program load (AIPL).

The IMPL/IMPLA sequence always refers to the use of internal storage as the data source for the initial machine loading of microcode. In general, the IMPL or IMPLA sequence consists of the following phases:

1. Machine Initialization
2. An MI load and build of the complete set of MI functions
3. Machine to programming transition

The IMPL or IMPLA will run Phase 1 and Phase 2 without interruption. If Rotary Switch 2 on the CE/operators panel is in position 2 (alternate initial process load - AIPL) the IMPL or IMPLA sequence will perform the machine to programming transition as described in 2.5.1.3.1. Any machine error detected during the IMPL or IMPLA sequence that cannot be corrected will cause an IMPL or IMPLA

halt (refer to 2.5.14). Should this occur, the machine enters the check stop state.

The IMPL or IMPLA sequence initializes the load/dump device. The console is not activated or used by the machine during the IMPL or IMPLA sequence. It is the responsibility of the MI user to activate the console after the machine programming transition (IPL or AIPL) occurs.

2.5.1.1 IMPL

IMPL can be initiated as the result of a manual power or auto power on (Auto-IMPL) or the load pushbutton being pressed when the first rotary switch is set to IMPL. The IMPL sequence consists of the diagnostic testing of the machine base hardware. The machine is initialized such that all machine components are initialized. The status of the machine following an IMPL can be obtained by programming through materialization of the machine initialization status record (MISR) machine attribute.

2.5.1.2 IMPLA

IMPLA can be initiated as a result of a power on or the Load pushbutton pressed when the first rotary switch is set to IMPLA. The IMPLA sequence differs from the IMPL sequence in that for IMPLA some of the hardware diagnostic functions are not performed. Other than this, the IMPLA sequence is similar to the IMPL sequence. The status of the machine following an IMPLA can be obtained by programming using the machine initialization status record machine attribute.

2.5.1.3 Machine To Programming Transition

The machine to programming transition occurs when a process is implicitly created by the machine (IPL or AIPL). See Section 2.3 Machine to Programming Transition. The setting of the second rotary switch determines the media (auxiliary storage) or external storage (load/dump) on which the data used to create the initial process resides. If the second rotary switch is set to the Alternate Initial Program Load (AIPL) the machine loads data from the load/dump. If the second rotary switch is set to any position other than the AIPL position, the normal Initialization of a Programming System (IPL) is done using MI objects that reside on auxiliary storage.

2.5.1.3.1 IMPL OR IMPLA WITH AIPL

AIPL is the loading of user defined data from the Primary Load/Dump device onto the machine. AIPL is always preceded by an IMPL or IMPLA.

AIPL Source Data Description

The data that is read from the load/dump device external storage at AIPL consists of:

- A User Profile Attribute Template, the format of which is documented in Authorization Management Instructions.
- A Program Template, the format of which is documented in Program Management Instructions.
- A Process Definition Template, the format of which is documented in Process Management Instructions.

The character scalar can exist on the load/dump device in one of two formats. The format of the character scalar is determined by the mechanism used AIPL Character Scalar Format

to write the AIPL source data out to the load/dump device. If the AIPL source data was written out to the load/dump device via data interchange, it will contain a character scalar format as defined by figure 2.5.1.3.1. If the AIPL source data was written out to the load/dump device by the load/dump function (space object) the space object contains a character scalar formatted according to figure 2.5.1.3.1.

Regardless of how the character scalar was written to the load/dump device (data interchange or load/dump space object) the character scalar or space object must begin on the first file of the load/dump device and must not be on more than one volume. If the first file does not contain the AIPL source data, an IMPL/IMPLA halt occurs.

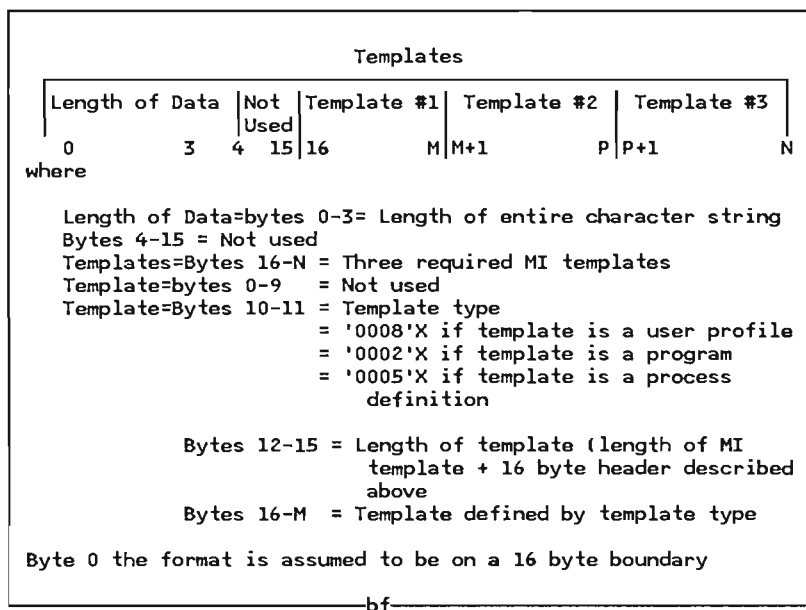


Figure 2.5.1.3.1 AIPL MI Source Data Format

The function performed by the machine when an AIPL occurs is documented in 2.1 (Initial Process Creation Function) of this document.

2.5.1.3.2 IMPL OR IMPLA WITH IPL

Normal IPL is the implicit creation of a process from MI Objects that resided on the auxiliary storage device. IPL is always initiated if the second CE panel rotary switch is not set to the AIPL position. Section 2.3.2, IPL MI Encapsulated Data describes the programming considerations required before an IPL can be initiated by the machine.

2.5.1.4 IMPL/IMPLA Halt

IMPL or IMPLA Halt are uncorrectable errors detected during the IMPL or IMPLA sequence that causes the machine to enter the check stop state. The sequence indicators on the CE/Op panel are activated to display a code corresponding to the type of error condition detected. These errors may be due to either an error in the format or content of the data on the AIPL source diskette, an I/O error on the media itself, or a machine failure. It is the responsibility of the CE or operator to determine from this code the actions that are to be performed. If the error was a result of invalid input data or an I/O error on the load/dump device, the machine check light will not be lit.

2.6 S/38 POWER WARNING FEATURE

The S/38 provides a power warning feature that can be connected to a user-provided uninterruptible power system (UPS). Both full and mini UPS's are supported. The full UPS will supply power to the entire S/38 for specific periods of time (function of the UPS) during utility power outages such that the system may continue to operate or terminate in a more controlled manner when the utility power supply is interrupted. The mini UPS powers only the main and feature frames of the system, all other DASD and I/O devices will not be powered. During power outages the mini UPS will power the system for a user-defined interval of time, and if utility power does not return within that interval, the system will be powered down. If utility power does return within that interval the system will continue processing. I/O devices, (tape drives, workstations, etc) and applications may have to be restarted. These conditions are signaled to a S/38 program via the Power Warning Feature Activated and Power Warning Feature Deactivated S/38 events.

Power-On While On UPS

The S/38 does not support S/38 activation (IPL) while the S/38 is being powered by either the full or mini UPS. If the utility power is off and the system is powered up using the UPS, the system will power up to a certain point and power back down. If

utility power fails while the system is powering up and before a S/38 program has informed the system, via the MODIFY MACHINE ATTRIBUTE, that the program is ready to handle power failures, the system will power down.

2.7 AUTO-IMPL

Auto IMPL is a special S/38 feature that provides the capability for the system to initiate an IMPL following a power failure. If the system's utility power fails and the Auto IMPL switch on the operator service panel is set to on, the system will power up automatically and perform an IMPL provided the Auto-IMPL feature has not been deactivated. The Auto-IMPL feature is deactivated whenever the system is powered down via either the TERMINATE MACHINE PROCESSING S/38 instruction and the termination option of the instruction is "do not allow an Auto-IMPL". The Auto-IMPL feature is also deactivated whenever the system is powered down via the rotary switches on the operator/service panel or whenever the Auto-IMPL switch on the operator's CE panel is set to "OFF".

A S/38 program can determine if the system is powered-on via the Auto-IMPL feature by materializing the Machine Initialization Status Record Machine Attribute.

3.0 SOURCE/SINK CONFIGURATION

3.1 GENERAL CONSIDERATIONS

Source/Sink configuration involves the creation of the various objects (LUD's, CD's and ND's) which are necessary to support the physical input/output devices on each system. Since the set of devices which are attached to each system is variable and since each of these devices has many capabilities and functions available in the hardware, then the Source/Sink objects to be created must be personalized to match all of these various characteristics. Some of these Source/Sink objects can be created at the time the system is manufactured since the device characteristics are known at that time. Examples of these devices are the system console device, the system printer and the Load/Dump device. Other objects will need to be created at the time the system is installed since these devices were not necessarily known at the time of manufacture. Other objects will need to be created subsequent to system installation as new devices are added on as system usage grows. Creation of the Source/Sink objects is a prerequisite to any actual use of those corresponding devices on the system.

Whenever the Source/Sink objects are created, certain actions must have taken place prior to this creation in order to ensure the uniqueness and integrity of the S/S objects. The system maintenance capabilities are used to first install the physical hardware (I/O device or control unit or communications adapters) and to update the internal machine configuration records to reflect this hardware. The maintenance function may also be required to install the necessary microcode support components for these physical devices. Creation of the Source/Sink objects is not allowed to proceed if confirmation of both of these maintenance activities cannot be confirmed. The extent of this checking is as follows:

1. Microcode support components must exist in the system prior to creation of any corresponding LUD, CD, or ND objects.
2. Machine configuration records must reflect the installation of all physical hardware prior to creation of any corresponding ND, CD, or LUD type 00 objects.
3. There is no checking of physical hardware installation for any CD type 10, or LUD type 20 or type 30 objects.

3.2 LOCAL DEVICES

All local devices on System/38 are represented by LUD type 00 objects with no requirement for

associated CD or ND objects or by a LUD type 10 object attached to a CD type 00 object. Refer to the appropriate device sections of this specification for definitions of the device specific details required for creation of their respective CD and/or LUD objects.

3.3 COMMUNICATIONS DEVICES

The following paragraphs provide information necessary for the configuration of communications lines, controllers, and terminals attached to System/38.

The configuration of a communications line is represented by a network description (ND). A controller description (CD) exists for each station or controller and a logical unit description (LUD) exists for each logical unit capable of maintaining a session whether the logical unit represents a hardware device, a program in another CPU, or any other "end use" mechanism.

3.3.1 COMMUNICATION LINE CONFIGURATION

This section provides the information necessary to configure a communications line on System/38. Specialization is the means by which the proper microcode components are associated with the protocol and hardware assigned to the line.

Since the microcode components are designed to support various protocols and hardware based upon parameters maintained in the ND, it is essential that the complete configuration be carefully analyzed so that the parameters match the desired support. For example, failure to specify modem characteristics correctly will result in a poorly functioning or non-functioning line.

The following sections list the parameters that must be specified for particular line configurations.

3.3.1.1 SDLC Primary Line Configuration

To configure an SDLC remote communications line upon which System/38 assumes the role of the Primary station, build the Network Description template described in MI Architecture, with the fields set as follows:

- ND Type: Specify C'00'
- Number of Backward Object Pointers: See text

- Physical Address: X'000000000000nnnn'

- OU# (nnnn):

Specify X'0020' for comm subsystem 1, line 0
 X'0021' for comm subsystem 1, line 1
 X'0022' for comm subsystem 1, line 2
 X'0023' for comm subsystem 1, line 3
 X'0060' for comm subsystem 2, line 0
 X'0061' for comm subsystem 2, line 1
 X'0062' for comm subsystem 2, line 2
 X'0063' for comm subsystem 2, line 3
 X'00A0' for comm subsystem 3, line 0
 X'00A1' for comm subsystem 3, line 1
 X'00A2' for comm subsystem 3, line 2
 X'00A3' for comm subsystem 3, line 3

- Line Definition:

- Line Discipline: SDLC

- Switched Network: (YES/NO)

- Switched Network Backup Feature: (YES/NO)

- Data Rate Select: (YES/NO)

- Role: PRIMARY

- NRZI: (YES/NO)

- New Sync: (YES/NO)

- Non-clocked modem: (YES/NO)

- OEM Modem: (YES/NO)

- Four-Wire Line(s): 100,01,10,11)

- Multipoint: (YES/NO)

- Autodial Feature: (0/1)

- Auto Answer Feature: (0/1)

- Auto Answer Sequence: (0/1)

- Answer Tone Generation: (YES/NO)

- Marks/spaces for answer Tone: (0/1)

- Special Answer Tone: (YES/NO)

- DCE Group: (00, 10, 01)

- Line Speed: 'rate' divided by 100

- Secondary address: X'0000'

- User Assigned Identification: Binary zero or user assigned value

- Exchange Identification Data: This field in the template is ignored by the CREATE instruction. Refer to the text for the meaning of this field on MATERIALIZE ND.

- Selectable Modes:

- Switched Network Backup Mode: (0/1) - 1 only if switched network backup feature is specified above

- Selected Rate: (0/1) - 1 only if data rate select is specified above

- Switched Connect Method: (Nonsw/Dialin/Dialout/Either)

- Autodial Mode: (0/1) - 1 only if Autodial feature is specified above

- Auto Answer Mode: (0/1) - 1 only if Auto answer feature is specified above

- Character Encoding: (0/1) - 0 = EBCDIC; 1 = ASCII

- All other entries: Specify zero

- Communications Subsystems Parameters:

- Data Terminal Ready Delay: value (0-15)

- Delayed Contact Timer: value (0-600)

- Idle State Detection Timer: value (0-255)

- Non Productive Receive Timer: value (0-255)

- Specific Characteristics:

- Specific Characteristics Length: X'0000'

- RETRY VALUE SETS:

- Retry Value Length: Specify 144 bytes

- Specify the following Error Types and Error Retry Values:

Error-Type	Error-Retry-Value
X'E324'	Value (0-21)
X'E2E4'	Value (0-21)
X'E526'	Value (0-21)
X'E566'	Value (0-21)
X'E586'	Value (0-21)
X'E5E6'	Value (0-21)
X'E606'	Value (0-21)
X'E546'	Value (0-21)
X'E5A6'	Value (0-21)
X'E5C6'	Value (0-21)
X'E626'	Value (0-21)
X'E2C4'	Value (0-21)
X'E506'	Value (0-21)
X'F4C2'	Value (0-21)
X'F507'	Value (0-21)
X'F517'	Value (0-21)
X'F527'	Value (0-21)
X'F805'	Value (0-21)
X'F7C5'	Value (0-21)
X'F660'	Value (0-21)
X'F705'	Value (0-21)
X'F7A5'	Value (0-21)
X'F441'	Value (0-21)
X'F481'	Value (0-21)

- Line Specific Contents:

- Line Specific Contents Length:
Specify X'0002'
- Line Specific Contents Modifiable Length:
Specify X'0002'
- Line Specific Contents:
Set the two bytes to X'0000'

Number of Backward Objects

This field represents the number of controllers which can be attached to this ND if it is a nonswitched line. This number is not supplied at CREATE ND time but is incremented by each CREATE CD for controllers attached to this line. A maximum of 128 controllers is supported on any primary line.

Line Discipline

This field must be set for SDLC.

Switched Network

This field describes the principal attachment method for the line. If the attachment is to the public switched network code YES. Attention must then be given to the specialization parameters concerned with switched line. If the attachment is to a non-switched facility (even if Switched Network Backup exists) code NO.

Switched Network Backup Feature (SNBU)

If the principal attachment method is non-switched and the System/38 Data Communications Equipment (DCE) has this optional feature, code this field YES. If you have SNBU on this line, it is necessary to specify the other switched line parameters. Code this field NO if SNBU is not featured.

Data Rate Select

If the System/38 DCE is capable of assuming either normal or half speed, code this field YES. Otherwise, code NO.

Role

Code this field PRIMARY.

NRZI

This field specifies whether or not System/38 and the remote station are operating in 'non-return-to-zero-inverted'. Both System/38 and the remote station must be in the same mode. Typically, when internal clock is used on the line, as is the case with the 38LS Integrated Modem, NRZI should be coded YES. However, if the DCE is sensitive to the bit pattern 1010.....10, it may be necessary to code this field NO. In these instances, it will be necessary to consult the IBM representative or the vendor modem installer. In any case, both System/38 and the remote station must use the same encoding scheme.

New Sync

If this communication line is a multipoint leased configuration and the Data Communications Equipment (DCE) requires the new synchronization (or new signal condition) on the interface, specify this parameter as YES. It may be necessary to consult the IBM representative or the vendor modem installer to determine whether the modem uses this signal.

Non-Clocked Modem

If the System/38 DCE uses an internally derived clock for received data timing, code this field YES. For example, the 38LS Integrated Modem requires internal clock. If the DCE provides its own clocking function, code this field NO.

OEM Modem

This field, if coded YES, indicates non-IBM data communications equipment (DCE) is installed.

Four-Wire Line(s)

This field specifies whether or not the normal communications facility and the backup facility (if installed) is four-wire. This field does not specify a duplex or half duplex data transfer. Code 1 for a four-wire facility and 0 for two-wire facility for each of the 2 bits. Bit 16 pertains to the switched backup line (if applicable) and bit 17 pertains to the normal communications line.

Multipoint

Code this field YES if System/38 is operating on a multipoint line. If Switched Network was coded YES, then Multipoint must be coded NO.

Auto Dial Feature

If dial out operations on this line are to be accomplished through an Auto Call Unit, code this field YES. The following conditions must be met if you have coded this field YES.

- The Data Access Arrangement (DAA) to the public switched network must be type 'CBS'.
- The Switched Network field is coded YES or the Switched Network Backup feature is coded YES.
- An Auto Call Unit must occupy the next line position on System/38.

If Auto Dial is not desired, code this field NO.

Auto Answer Feature

If the System/38 DCE is capable of Auto answer and the following conditions are met, then code this field YES.

- The DAA is type 'CBS'
- Switched Network Field is coded YES or Switched Network Backup Feature is coded YES.

If the Auto answer feature is not present or the conditions are not met, code this field NO.

Auto Answer Sequence

If you have coded Auto Answer Feature YES, it is necessary to specify the sequence of operations taken by System/38 with regard to the DCE. The answer sequence is of significance when World Trade DCE's are used. Code this field=0 if the DCE is of U.S. or Canadian origin. Code the field=1 if the World Trade DCE requires the DTR signal on the interface to be raised after receiving DSR. Code the field=0 if DTR should be raised after RI which then causes DSR to be raised. Specific details of the auto answer sequence may be obtained from the IBM Representative.

Answer Tone

This field indicates whether or not System/38 must generate an 'answer tone' signal to the remote DCE because the System/38 DCE does not do so. It is normally appropriate to code this field NO. However, DCE in the World Trade environment predating the CCITT recommendations V.25 and not capable of auto answer may not generate answer tone. For such equipment, consult the vendor representative and code this field YES if appropriate. Do not specify this field unless Switched Network or Switched Network Backup are coded YES.

Send Marks for Answer tone

If the answer tone field is coded YES then this field must be specified. If this field is coded NO(0), the Answer Tone signal will be accomplished by transmitting 'spaces' (binary 0) for 3.5 seconds. If this field is coded YES (1), Answer Tone is accomplished by transmitting 'marks' (binary 1) for 3.5 seconds. Consult the vendor representative for the correct signal.

Special Answer Tone

If Switched Network or Switched Network Backup is coded YES, the System/38 DCE is a 38LS Integrated Modem, and the remote DCE is a Western Electric 202 or other modem requiring a 2025 hertz answer tone, then code this field YES. Otherwise code the field NO.

DCE Group

Code this field = 00 for all leased lines or for switched or switched backup lines outside the USA or Canada which have IBM integrated modems. Code this field = 01 for switched or switched backup lines outside the USA and Canada which do not have IBM integrated modems. Code this field = 10 for switched or switched backup lines in USA or Canada.

Line Speed

This field is specified by coding the line speed divided by 100. For example, 1,200 BPS is coded as 12. Permissible values are 12 (1,200 BPS), 20 (2,000 BPS), 24 (2,400 BPS), 48 (4,800 BPS), 72 (7,200 BPS) or 96 (9,600 BPS). For high speed

lines, values of 480 (48K BPS) or 560 (56K BPS) are also supported. If a high speed value is selected, no other lines on the same communication subsystem can run concurrently with this line. For various non-standard modem rates, the closest value above should be specified.

Secondary Address

This field is not used for a primary SDLC configuration.

Exchange Identification Data and User Assigned ID

Refer to the descriptions in Section 3.3.1.3 (for Secondary SDLC lines) for these parameters. Starting with Feature Group 5 these parameters can optionally be used for primary SDLC lines also.

DTR Delay - Value (0-15)

This parameter specifies the number of 200 millisecond periods that System/38 waits after setting Data Terminal Ready to the inactive state. For most networks, 200 milliseconds (value=1) is appropriate. However, World Trade countries may require a longer delay. The maximum allowable value is 15 (which is equivalent to 3 seconds). If zero is specified, a default time of 100 milliseconds is used.

Delayed Contact Timer - Value (0-600)

This parameter specifies in one second intervals the amount of time to be delayed before re-polling each non-responding controller on the leased communication line if the controller(s) have been specified as Delayed Contact = Yes. The maximum value allowed (600) is ten minutes. If zero is specified, a 60 second default will be used.

Idle State Detection Timer - Value (0-255)

This parameter must be specified in 53.3 millisecond periods as specified in GA27-3093 IBM Synchronous Data Link Control General Information. The value you specify is determined by the type of channel, controller modem clear to send delay, and an approximation of the propagation delay. If zero is specified, a time of 500 milliseconds will be used. The maximum value allowed is 255 which allows a 13.6 second delay. A recommended value is 38 which provides approximately a two-second timer.

Nonproductive Receive Timer - Value (0-255)

This parameter specifies the value in 500 millisecond periods which allow for the reception of an unintelligible signal for a length of time adequate to encompass the normal transmission. Presumably, the secondary controller will pause to await confirmation. Normally 3-20 seconds (value =6-40) is adequate. The maximum value allows a 127.5 second pause. If zero is specified, a time of 128 seconds is used. The following recommend values are given as a function of line speed and are appropriate for 5250 devices transmitting frames of 266 bytes or for LU6.2 devices transmitting 270 byte or 521 byte frames:

<u>Line-Speed</u>	<u>266-270 Byte Frames</u>		<u>521 Byte Frames</u>	
	<u>Value</u>	<u>Time</u>	<u>Value</u>	<u>Time</u>
600	11	5.5 sec	22	11.0 sec
1200	6	3.0	12	6.0
2400	4	2.0	8	4.0
4800	2	1.0	4	2.0
9600	2	1.0	2	1.0
48K-56K	1	0.5	1	0.5

If the line has data rate select feature and is to be used at the lower speed select that appropriate value in the table above.

Retry Values

These limits establish the number of consecutive occurrences of a retryable error that will be tolerated before the station or line is declared inoperative. Most Communications Line users will prefer to set the retry limits to the recommended values.

Retry Value Length: Specify 144 bytes

<u>Type Code</u>	<u>Error</u>	<u>Recommended Value</u>
X'E324'	Clear to send inactive	7
X'E2E4'	Clear to send active before request to send	7
X'E526'	Data line occupied	1
X'E566'	Present Next Digit inactive after Call Request Set (AUTODIAL)	1
X'E586'	Present Next Digit active after Digit Present Set (AUTODIAL)	1
X'E5E6'	Present Next Digit inactive after Digit Present Reset (AUTODIAL)	1
X'E606'	Distant Station Connected Inactive	1
X'E546'	Present Next Digit inactive After Call Request Set - ACR (Abandon Call and Retry) - (AUTODIAL)	1
X'E5A6'	Present Next Digit Active after Digit Present Set - ACR (AUTODIAL)	1
X'E5C6'	Present Next Digit Inactive after Digit Present Reset - ACR (AUTODIAL)	1
X'E626'	Distant Station Connected Inactive and ACR	1
X'E2C4'	Request to Send Inactive	7*
X'E506'	General Autodial Error	1
X'F4C2'	Adapter Overrun/Underrun	7
X'F507'	Unrecognizable SDLC Control Field	7
X'F517'	SDLC Sequence Number Error, Transmit Error	7
X'F527'	SDLC Sequence Number Error, Receive Error	7
X'F805'	CRC Error	7
X'F7C5'	Frame Abort Detected (Pattern '01111111'B)	7
X'F660'	CPU Buffer Overflow (on Input)	7
X'F705'	Idle State Detected	7
X'F7A5'	Non-Productive Receive Timeout	7
X'F441'	Data Overrun (Receive)	7
X'F481'	Data Underrun (Transmit)	7

*This retry limit must be the same as for error code E324.

It is suggested that the Line Specialization interface to the user categorize the preceding errors and allow individual error retry

specification only at the user's request. Errors could be generalized as follows:

<u>Error-Category</u>	<u>Type-Codes-</u>
Dial Errors	E526, E566, E586, E5E6, E606, E546, E5A6, E5C6, E626, E506
Telecommunications Errors	E324, E2E4, E2C4, F4C2, F507, F517, F527, F805, F7C7, F660, F705, F7A5, F441, F481

3.3.1.2 Reserved

3.3.1.3 SDLC Secondary Line Configuration

To configure an SDLC remote communications line upon which System/38 assumes the role of a secondary station, build the Network Description template described in MI Volume III, Section 17, with the fields set as follows:

- ND Type: Specify C'00'
- Number of Backward Object Pointers: Not more than one
- Physical Address: X'000000000000nnnn'
 - OU# (nnnn): Specify X'0020' for comm subsystem 1, line 0
X'0021' for comm subsystem 1, line 1
X'0022' for comm subsystem 1, line 2
X'0023' for comm subsystem 1, line 3
X'0060' for comm subsystem 2, line 0
X'0061' for comm subsystem 2, line 1
X'0062' for comm subsystem 2, line 2
X'0063' for comm subsystem 2, line 3
X'00A0' for comm subsystem 3, line 0
X'00A1' for comm subsystem 3, line 1
X'00A2' for comm subsystem 3, line 2
X'00A3' for comm subsystem 3, line 3
- Line Definition:
 - Line Discipline: SDLC
 - Switched Network: (YES/NO)
 - Switched Network Backup Feature: (YES/NO)
 - Data Rate Select: (YES/NO)
 - Role: SECONDARY
 - NRZI: (YES/NO)
 - New Sync: (NO)
 - Non-clocked modem: (YES/NO)
 - OEM Modem: (YES/NO)
 - Four-Wire Line(s): (00, 01, 10, 11)
 - Multipoint: (YES/NO)
 - Autodial Feature: (0/1)
 - Auto Answer Feature: (0/1)
 - Auto Answer Sequence: (0/1)
 - Answer Tone Generation: (YES/NO)
 - Marks/spaces for answer tone: (0/1)
 - Special Answer Tone: (YES/NO)
 - DCE Group: (00, 10, 01)
 - Line Speed: 'rate' divided by 100
 - Secondary address: Specify address in hex as

- first byte (values '01'X through 'FE'X allowed), set second byte to '00'X
- User Assigned Identification: Binary zero or user assigned value

• Exchange Identification Data:

This field in the template is ignored by the CREATE instruction. Refer to the text for the meaning of this field on MATERIALIZE ND.

• Selectable Modes:

- Switched Network Backup Mode: (0/1) - 1 only if switched network backup feature is specified above.
- Selected Rate: (0/1) - 1 only if data rate select is specified above.
- Switched Connect Method: (Nonsw/Dialin/Dialout/Either).
- Autodial Mode: (0/1) - 1 only if Autodial feature is specified above.
- Auto Answer Mode: (0/1) - 1 only if Auto answer feature is specified above.
- Switched Secondary Line Inactivity Disconnect Timeout: (0/1) - 1 set to 0 only if the normal inactivity timeout detection is to be inhibited. Applicable only if switched network feature is specified above.
- All other entries: Specify zero.

• Communications Subsystems Parameters:

- Data terminal Ready Delay: value (0-15)
- Delayed Contact Timer: value (0)
- Idle State Detection Timer: value (0-255)
- Non-Productive Receive Timer: value (0-255)

• Specific Characteristics:

- Specific Characteristics Length: X'0000'

• RETRY VALUE SETS:

- Retry Value Length: Specify 144 bytes
- Specify the following Error Types and Error Retry Values:

Error-Type	Error-Retry-Value
X'E324'	Value (0-21)
X'E2E4'	Value (0-21)
X'E526'	Value (0-21)
X'E566'	Value (0-21)
X'E586'	Value (0-21)
X'E5E6'	Value (0-21)
X'E606'	Value (0-21)
X'E546'	Value (0-21)
X'E5A6'	Value (0-21)
X'E5C6'	Value (0-21)
X'E626'	Value (0-21)
X'E2C4'	Value (0-21)
X'E506'	Value (0-21)
X'F4C2'	Value (0-21)
X'F507'	Value (0-21)
X'F517'	Value (0-21)
X'F527'	Value (0-21)
X'F805'	Value (0-21)
X'F7C5'	Value (0-21)

X'F660'	Value (0-21)
X'F705'	Value (0-21)
X'F7A5'	Value (0-21)
X'F441'	Value (0-21)
X'F481'	Value (0-21)

• Line Specific Contents:

- Line Specific Contents Length: Specify X'0002'
- Line Specific Contents Modifiable Length: Specify X'0002'
- Line Specific Contents: Set the two bytes to X'0000'

Line Discipline

This field must be set for SDLC.

Switched Network

This field describes the principal attachment method for the line. If the attachment is to the public switched network code YES. Attention must then be given to the specialization parameters concerned with switched line. If the attachment is to a non-switched facility (even if Switched Network Backup exists) code NO.

Switched Network Backup Feature (SNBU)

If the principal attachment method is non-switched and the System/38 Data Communications Equipment (DCE) has this optional feature, code this field YES. If you have SNBU on this line, it is necessary to specify the other switched line parameters. Code this field NO if SNBU is not featured.

Data Rate Select

If the System/38 DCE is capable of assuming either normal or half speed, code this field YES. Otherwise, code NO.

Role

Code this field SECONDARY.

NRZI

This field specifies whether System/38 and the remote station are operating in 'non-return-to-zero-inverted' mode or not. Both System/38 and the remote station must be in the same mode. Typically, when internal clock is used on the line, as is the case with the 38LS Integrated Modem, NRZI should be coded YES. However, if the DCE is sensitive to the bit pattern 1010.....10, it may be necessary to code this field NO. In these instances, it will be necessary to consult the IBM representative or the vendor modem installer. In any case, both System/38 and the remote station must use the same encoding scheme.

New Sync

Specify this field as zero.

Non-Clocked Modem

If the System/38 DCE uses an internally derived clock for received data timing, code this field YES. For example, the 38LS Integrated Modem requires internal clock. If the DCE provides its own clocking function, code this field NO.

OEM Modem

This field, if coded YES, indicates non-IBM data communications equipment (DCE) is installed.

Four-Wire Line(s)

This field specifies whether or not the normal communications facility and the backup facility (if installed) is four-wire. This field does not specify a duplex or half duplex data transfer. Code 1 for a four-wire facility and 0 for a two-wire facility for each of the 2 bits. Bit 16 pertains to the switched backup line (if installed) and bit 17 pertains to the normal communication line.

Multipoint

Code this field YES if System/38 is operating on a multipoint line. If Switched Network was coded YES, then Multipoint must be coded NO.

Auto Dial Feature

If dial out operations on this line are to be accomplished through an Auto Call Unit, code this field YES. The following conditions must be met if you have coded this field YES:

- The Data Access Arrangement (DAA) to the public switched network must be type 'CBS'.
- The Switched Network field is coded YES or the Switched Network Backup feature is coded YES.
- An Auto Call Unit must occupy the next line position on System/38.

If Auto Dial is not desired, code this field NO.

Auto Answer Feature

If the System/38 DCE is capable of Auto answer and the following conditions are met, code this field YES:

- The DAA is type 'CBS'.
- Switched Network Field is coded YES or Switched Network Backup Feature is coded YES.

If the Auto answer feature is not present or the conditions are not met, code this field NO.

Auto Answer Sequence

If you have coded Auto Answer Feature YES, it is necessary to specify the sequence of operations taken by System/38 with regard to the DCE. The answer sequence is of significance when World Trade DCEs are used. Code this field = 0 if the DCE is of U.S. or Canadian origin. Code the field = 1 if the World Trade DCE requires the DTR signal on the

interface to be raised after receiving DSR. Code the field = 0 if DTR should be raised after RI which then causes DSR to be raised. Specific details of the auto answer sequence may be obtained from the IBM Representative.

Answer Tone

This field indicates whether or not System/38 must generate an 'answer tone' signal to the remote DCE because the System/38 DCE does not do so. It is normally appropriate to code this field NO. However, DCE in the World Trade environment predating the CCITT recommendations V.25 and not capable of auto answer may not generate answer tone. For such equipment, consult the vendor representative and code this field YES if appropriate. Do not specify this field unless Switched Network or Switched Network Backup are coded YES.

Send Marks for Answer tone

If the answer tone field is coded YES then this field must be specified. If this field is coded NO(0) the Answer Tone signal will be accomplished by transmitting 'spaces' (binary 0) for 3.5 seconds. If this field is coded YES(1), Answer Tone is accomplished by transmitting 'marks' (binary 1) for 3.5 seconds. Consult the vendor representative for the correct signal.

Special Answer Tone

If Switched Network or Switched Network Backup is coded YES, the System/38 DCE is a 38LS Integrated Modem, and the remote DCE is a Western Electric 202 code this field YES. Otherwise code the field NO.

DCE Group

Code this field = 00 for all leased lines and for switched or switched backup lines outside USA and Canada which have IBM integrated modems. Code this field = 01 for switched or switched backup lines outside USA and Canada which do not have IBM integrated modems. Code this field = 10 for switched or switched backup lines within USA or Canada.

Line Speed

This field is specified by coding the line speed divided by 100. For example, 1,200 BPS is coded as 12. Permissible values are 12 (1,200 BPS), 20 (2,000 BPS), 24 (2,400 BPS), 48 (4,800 BPS), 72 (7,200 BPS) or 96 (9,600 BPS). For high speed lines, values of 480 (48K BPS) and 560 (56K BPS) are also supported. If a high speed value is selected, no other lines on the same communication subsystem can run concurrently with this line. For various non-standard modem rates, the closest value above should be specified.

Secondary Address :

Specify the Link level address which will be used by the primary SDLC station (S/370 host or ISS peer system) to address this System/38.

Exchange Identification Data (for primary or secondary SDLC ND's) :

This field is not required as input data for creating either primary or secondary SDLC ND objects. Rather it is a machine-generated unique SNA XID which can be materialized (MAT ND) and provided externally to the far end SDLC station (S/370 host or ISS primary station or ISS secondary station) as the expected response from this System/38 when exchanging XID's. The uniqueness is established from the Machine Serial Number which is obtained from the internal Machine Configuration Record (MCR). The generated XID will have one of the following formats depending on the usage of the line. Only the first 6 bytes of the XID are shown in the ND object. The actual XID transmitted is defined within SNA documentation and can be much longer.

<u>Byte</u>	<u>Value</u>	<u>Description</u>
Byte 0 Bits 0-3	'0'X	XID Format Fixed - Used for secondary to LU1
	'3'X	Variable - Used for ISS primary and secondary
Byte 0 Bits 4-7	'2'X	PU Type
Byte 1	'00'X	XID Length. Zero is used for fixed format XIDs. The actual XID length transmitted is 6 bytes.
	'1D'X	For variable format 3, the length is specified as 29 bytes.
Bytes 2-5 Bits 0-11	'022'X	SNA Block Number assigned to System/38. Machine Serial (or User Assigned ID - See below)
Bits 12-14	'001'B U.S.A	Manufacturing Location. Derived from Bytes 0 and 1 of the machine serial number in the MCR.
	'010'B World Trade	
Bits 15-31	Binary value equivalent to the 5-digit machine serial number	Derived from Bytes 3-7 of the machine serial number in the MCR.
Bytes 6-15	Binary	Reserved in the ND object. (The actual values transmitted in the XID exchange are defined in SNA documentation.)
	Zero	

Note On XID's

Once ND's are created, primary NDs are shown as XID format 3 and secondary NDs are shown as XID format 0 even though secondary ND's actually use either format 0 or format 3 for XID transmission depending on whether exchange is with an LU1 primary or an ISS primary.

User Assigned ID

Optionally, the user can assign an ID by specifying a non-zero value in the User Assigned ID field of the Line Definition data in the Create ND template. If such a value is supplied it will override the machine generated value defined above for Bytes 2-5, bits 12-31.

Switched Secondary Line Inactivity Disconnect - Value (0/1)

This parameter should normally be set to 1 to provide normal interactivity timeout disconnection of the switched lines after prolonged period of line inactivity (length of the non productive receive timer value). It can be set to 0 to inhibit timeout disconnection as an aid to far end program debug or possible debug of internal System/38 support.

DTR Delay - Value (0-15)

This parameter specifies the number of 200 millisecond periods that System/38 waits after setting Data Terminal Ready to the inactive state. For most networks, 200 milliseconds (value=1) is appropriate. However, World Trade countries may require a longer delay. The maximum allowable value is 15 (which is equivalent to 3 seconds). If zero is specified, a default time of 100 milliseconds is used.

Delayed Contact Timer - Value (0)

Specify this parameter as zero.

Idle State Detection Timer - Value (0-255)

This parameter is ignored by the machine for secondary SDLC communications support.

Nonproductive Receive Timer - Value (0-255)

For switched secondary lines, this parameter specifies the value in 500 millisecond intervals for which prolonged periods of inactivity (from the primary) are allowed to occur. If valid frames of information are not received within this timeout value, the line will be disconnected. Normally 30 seconds is adequate and this value (60) should be used. The maximum value allowed specifies a 127.5 second timeout. If zero is specified, a time of 128 seconds will be used.

Retry Values

This limit establishes the number of consecutive occurrences of a retryable error that will be tolerated before the station or line is declared inoperative. Most Communications Line users will prefer to set the retry limits to the recommended values.

Retry Value Length: Specify 144 bytes

Type Code	Error	Recommended Value
X'E324'	Clear to send inactive	7
X'E2E4'	Clear to send active before request to send	7
X'E526'	Data line occupied	1
X'E566'	Present Next Digit inactive after Call Request Set (AUTODIAL)	1
X'E586'	Present Next Digit active after Digit Present Set (AUTODIAL)	1
X'E5E6'	Present Next Digit inactive after Digit Present Reset (AUTODIAL)	1
X'E606'	Distant Station Connected Inactive	1
X'E546'	Present Next Digit inactive After Call Request Set - ACR (Abandon Call and Retry) - (AUTODIAL)	1
X'E5A6'	Present Next Digit Active after Digit Present Set - ACR (AUTODIAL)	1
X'E5C6'	Present Next Digit Inactive after Digit Present Reset - ACR (AUTODIAL)	1
X'E626'	Distant Station Connected Inactive and ACR	1
X'E2C4'	Request to Send Inactive	*
X'E506'	General Autodial Error	1
X'F4C2'	Adapter Overrun/Underrun	7
X'F507'	Unrecognizable SDLC Control Field	7
X'F517'	SDLC Sequence Number Error, Transmit Error	7
X'F527'	SDLC Sequence Number Error, Receive Error	7
X'F805'	CRC Error	7
X'F7C5'	Frame Abort Detected (Pattern '01111111'B)	7
X'F660'	CPU Buffer Overflow (on Input)	7
X'F705'	Idle State Detected	7
X'F7A5'	Non-Productive Receive Timeout	7
X'F441'	Data Overrun (Receive)	7
X'F481'	Data Underrun (Transmit)	7

*This retry limit must be the same as for error code E324.

It is suggested that the Line Specialization interface to the user categorize the preceding errors and allow individual error retry specification only at the user's request. Errors could be generalized as follows:

Error-Category	Type-Codes-
Dial Errors	E526, E566, E586, E5E6, E606, E546, E5A6, E5C6, E626, E506
Telecommunications Errors	E324, E2E4, E2C4, F4C2, F507, F517, F527, F805, F7C7, F660, F705, F7A5, F441, F481

3.3.1.4 Binary Synchronous Communications Line Configuration

To configure a BSC remote communications line, build the Network Description template described in MI Volume III, Section 17 with the fields set as follows:

• ND Type: Specify C'00'

• Number of Backward Object Pointers: See text

• Physical Address: X'000000000000nnnn'

- OU# (nnnn):

Specify X'0020' for comm subsystem 1, line 0
 X'0021' for comm subsystem 1, line 1
 X'0022' for comm subsystem 1, line 2
 X'0023' for comm subsystem 1, line 3
 X'0060' for comm subsystem 2, line 0
 X'0061' for comm subsystem 2, line 1
 X'0062' for comm subsystem 2, line 2
 X'0063' for comm subsystem 2, line 3
 X'00A0' for comm subsystem 3, line 0
 X'00A1' for comm subsystem 3, line 1
 X'00A2' for comm subsystem 3, line 2
 X'00A3' for comm subsystem 3, line 3

• Line Definition:

- Line Discipline: BSC ('0100'B)
 - Switched Network: (YES/NO)
 - Switched Network Backup Feature: (YES/NO)
 - Data Rate Select: (YES/NO)
 - Role: Point to Point (0) or Multipoint (1)
 - NRZI: (NO)
 - New Sync: (NO)
 - Non-clocked modem: (YES/NO)
 - OEM Modem: (YES/NO)
 - Four-Wire Line(s): (00, 01, 10, 11)
 - Multipoint Physical Network: (YES/NO)
 - Multipoint Protocol (Not applicable/Tributary)
 - Autodial Feature: (0/1)
 - Auto Answer Feature: (0/1)
 - Auto Answer Sequence: (0/1)
 - Answer Tone Generation: (YES/NO)
 - Marks/spaces for answer Tone: (0/1)
 - Special Answer Tone: (YES/NO)
 - DCE Group: (00, 10, 01)
 - Line Speed: 'rate' divided by 100
 - Secondary address: (X'0000'/Multipoint Tributary Address)

• Selectable Modes:

- Switched Network Backup Mode: (0/1) - 1 only if switched network backup feature is specified above
 - Selected Rate: (0/1) - 1 only if data rate select is specified above
 - Character Encoding (0 = EBCDIC/1 = ASCII)
 - BSC Protocol Modes: (NORMAL/MTAM)
 - Switched Connect Method: (Nonsw/Dialin/Dialout/Either)
 - Autodial Mode: (0/1) - 1 only if Autodial feature is specified above
 - Auto Answer Mode: (0/1) - 1 only if Auto answer feature is specified above
 - BSC Switched Inactivity Disconnect timeout: 0/1 - set to 1 only if the normal line inactivity timeout is to be inhibited. Applicable only for switched lines.
 - All other entries: Specify binary zero

• Communications Subsystems Parameters:

- Data terminal Ready Delay: value (0-15)
- Delayed Contact Timer: value (0)
- Receive Timeout Timer: value (0-127)
- Reserved Timer: Specify binary zero

• Eligibility Object List

- System pointers to BSC CDs

• Specific Characteristics:

- Specific Characteristics Length: X'0000'

• RETRY VALUE SETS:

- Retry Value Length: Specify 18 bytes
- Specify the following Error Types and Error Retry Values:

<u>Error-Type</u>	<u>Error-Retry-Value</u>
X'E001'	Value (0-21)
X'E002'	Value (0-21)
X'E003'	Value (0-21)

• Line Specific Contents:

- Line Specific Contents Length: Specify X'0002'
- Line Specific Contents Modifiable Length: Specify X'0002'
- Line Specific Contents: Reserved '0000'X

Number of Backward Objects

This field represents the number of controllers which can be attached to this ND if it is a non-switched line. The number is not supplied at CREATE ND time but is incremented by each CREATE CD for controllers attaching to this line. The following maximums are supported:

BSC - one controller
BSC Tributary - one controller

Line Discipline

This field must be set for BSC.

Switched Network

This field describes the principal attachment method for the line. If the attachment is to the public switched network code YES. Attention must then be given to the specialization parameters concerned with switched line. If the attachment is to a non-switched facility (even if Switched Network Backup exists) code NO.

Switched Network Backup Feature (SNBU)

If the principal attachment method is non-switched and the System/38 Data Communications Equipment (DCE) has this optional feature, code this field YES. If you have SNBU on this line, it is necessary to specify the other switched line parameters. Code this field NO if SNBU is not featured.

Data Rate Select

If the System/38 DCE is capable of assuming either normal or half speed, code this field YES. Otherwise, code NO.

Role

Code this field as Point to Point if normal BSC is to be used. Code it multipoint if the System/38 is to provide BSC multipoint tributary support.

NRZI

Code this field = NO for BSC.

New Sync

Specify this field as zero.

Non-Clocked Modem

If the System/38 DCE uses an internally derived clock for received data timing, code this field YES. For example, the 38LS Integrated Modem requires internal clock. If the DCE provides its own clocking function, code this field NO.

OEM Modem

This field, if coded YES, indicates non-IBM data communications equipment (DCE) is installed.

Four-Wire Line(s)

This field specifies whether or not the normal communications facility and the backup facility (if installed) is four-wire. This field does not specify a duplex or half duplex data transfer. Code 1 for a four-wire facility and 0 for two-wire facility for each of the 2 bits. Bit 16 pertains to the switched backup line (if installed) and bit 17 pertains to the normal communication line.

Multipoint Physical Network

This field must be coded NO if the physical network is point to point. It must be coded yes if the physical network is multipoint (required for multipoint tributary support).

Multipoint Protocol

Code this field (0) (Not Applicable) if normal BSC support is used. Code this field (1) if multipoint tributary support is to be used.

Auto Dial Feature

If dial out operations on this line are to be accomplished through an Auto Call Unit, code this field YES. The following conditions must be met if you have coded this field YES.

- The Data Access Arrangement (DAA) to the public switched network must be type 'CBS'.
- The Switched Network field is coded YES or the Switched Network Backup feature is coded YES.

- An Auto Call Unit must occupy the next line position on System/38.

If Auto Dial is not desired, code this field NO.

Auto Answer Feature

If the System/38 DCE is capable of Auto answer and the following conditions are met, then code this field YES.

- The DAA is type 'CBS'.
- Switched Network Field is coded YES or Switched Network Backup Feature is coded YES.

If the Auto answer feature is not present or the conditions are not met, code this field NO.

Auto Answer Sequence

If you have coded Auto Answer Feature YES, it is necessary to specify the sequence of operations taken by System/38 with regard to the DCE. The answer sequence is of significance when World Trade DCE's are used. Code this field=0 if the DCE is of U.S or Canadian origin. Code the field=1 if the World Trade DCE requires the DTR signal on the interface to be raised after receiving DSR. Code the field=0 if DTR should be raised after RI which then causes DSR to be raised. Specific details of the auto answer sequence may be obtained from the IBM Representative.

Answer Tone

This field indicates whether or not System/38 must generate an 'answer tone' signal to the remote DCE because the System/38 DCE does not do so. It is normally appropriate to code this field NO. However, DCE in the World Trade environment predating the CCITT recommendations V.25 and not capable of auto answer may not generate answer tone. For such equipment, consult the vendor representative and code this field YES if appropriate. Do not specify this field unless Switched Network or Switched Network Backup are coded YES.

Send Marks for Answer tone

If the answer tone field is coded YES then this field must be specified. If this field is coded NO(0), the Answer Tone signal will be accomplished by transmitting 'spaces' (binary 0) for 3.5 seconds. If this field is coded YES(1), Answer Tone is accomplished by transmitting 'marks' (binary 1) for 3.5 seconds. Consult the vendor representative for the correct signal.

Special Answer Tone

If Switched Network or Switched Network Backup is coded YES, the System/38 DCE is a 38LS Integrated Modem, and the remote DCE is a Western Electric 202 code this field YES. Otherwise code the field NO.

DCE Group

Code this field = 00 for all leased lines or for switched or switched backup lines outside the USA or Canada which have IBM integrated modems. Code this field = 01 for switched or switched backup lines outside the USA and Canada which do not have IBM integrated modems. Code this field = 10 for switched or switched backup lines in USA or Canada.

Line Speed

This field is specified by coding the line speed divided by 100. For example, 1,200 BPS is coded as 12. Permissible values are 12 (1,200 BPS), 20 (2,000 BPS), 24 (2,400 BPS), 48 (4,800 BPS), 72 (7,200 BPS) or 96 (9,600 BPS). For high speed lines, values of 480 (48K BPS) and 560 (56K BPS) are also supported. If a high speed value is selected, no other lines on this communication subsystem can run concurrently with this line. For various non-standard modem rates, the closest value above should be specified.

Secondary Address

Code this field '0000'X if normal point to point BSC support is used. Code this field to contain the data link address to which the System/38 should respond if multipoint tributary support is used.

Character Encoding

Code this field 0 if data is to be in EBCDIC format. Code as 1 if data is to be in ASCII format.

BSC Protocol Modes

Code this field 000 for normal modes of operation. Code this field as 001 for MTAM protocol mode if MRJE operations are to be performed.

BSC Switched Inactivity Disconnect Timeout - (0/1)

This parameter is used only during abnormal conditions such as when program activity would fail to provide proper I/O operations to the BSC line in a timely fashion thereby causing timeout and disconnection of the switched line. Setting this indicator to 1 will inhibit the timeouts in order to assist in isolating the program problem. Coordination of timeout disconnection at the remote end of the link must also be managed for this function. Normally this indicator should be set to 0 to specify normal timeout detection.

In BSC MTAM mode this parameter is not applicable.

DTR Delay - Value (0-15)

This parameter specifies the number of 200 millisecond periods that System/38 waits after setting Data Terminal Ready to the inactive state. For most networks, 200 milliseconds (value=1) is appropriate. However, World Trade countries may require a longer delay. The maximum allowable value is 15 (which is equivalent to 3 seconds). If zero is specified, a default time of 100 milliseconds is used.

Delayed Contact Timer - Value (0)

Specify zero for this parameter.

Receive Timeout Timer - Value (0-127)

This parameter must be specified in 200 millisecond periods as the receive timeout period according to BSC specification CP-AR-00658-RAL. The value you specify is determined by the type of channel, controller modem clear-to-send delay, and an approximation of the propagation delay. For most networks, 3 seconds (value=15) is appropriate. If zero is specified, no receive timeout will occur (infinite timeout). The maximum value allowed is 127 which allows a 25.4 second delay.

Nonproductive Receive Timer - Value (0)

This is a reserved field for BSC. Specify X'0000'.

Eligibility Object List

For switched BSC NDs, this field must contain a minimum of 1 and a maximum of 8 BSC CDs which are eligible to call in on this ND.

Retry Values

These limits establish the number of consecutive occurrences of a retryable error that will be tolerated before the station or line is declared inoperative. Most Communications Line users will prefer to set the retry limits to the recommended values.

Retry Value Length: Specify 18 bytes

Type Code	Error	Recommended Value	Range
X'E001'	Error during contention	7	0-21
X'E002'	Error during data transfer	7	0-21
X'E003'	Switched connect retry	1	0-21

3.3.2 COMMUNICATIONS CONTROLLER CONFIGURATION

Each of the stations (or communications controllers) which are members of a communication network must likewise have a proper set of attributes and protocols assigned to the Controller Description object (CD) which is to represent this member of the network. This characterization must be done properly to ensure compatibility with the communication line protocols (as defined for the corresponding Network Description object (ND)) to ensure a properly functioning communications network. In the case of public switched communications networks, as well as for local or leased communications attachments, it is a requirement to have a uniquely defined CD object for any possible communications station which desires a connection to the System/38 system.

The available selections for the various parameters required for creating the Controller Description object for each type of station which is supported by this model of the System/38 is not defined here. Refer to the Communications Device Management section of this document (Sections 5.2 and 5.5). for these parameter selections which are described there in conjunction with other operational usages and considerations.

3.3.3 COMMUNICATIONS LOGICAL UNIT CONFIGURATION

Each of the end use devices (called logical units) which are associated with the stations in the communication network must also be described properly by a selection of attributes to be assigned to the Logical Unit Description object (LUD) which represents that end-use mechanism. As in the case of the controllers, the available selections for each type of end use device supported on this model of System/38 are described in Sections 5.2 and 5.5, Communications Device Management.

4.0 LOCAL SOURCE/SINK DEVICES

4.1 MACHINE CONSOLE

The machine console is a unique input/output device in that every machine has one and only one console and it is the primary interface by which the operator monitors and controls the operation of the machine.

4.1.1 PROGRAMMING CONSIDERATIONS

The basic object of control is the Logical Unit Description (LUD). All references to a device are made with respect to the LUD. The CREATE, MODIFY, and DESTROY LUD instructions control the environment in which the console operates. The REQIO instruction controls the console device and causes data to be passed to and from the device. Because the console is an integral part of the System/38, the LUD for the console should be created early (see 4.1.2) and varied on so the programming system can interface with the operator.

Before REQIO operations can be accepted, several steps must have occurred.

- A LUD must have been created through the use of the CREATE LUD instruction.
- The console must have been varied on through the use of the MODLUD instruction.
- The LUD must be made active through the use of the MODLUD instruction.

4.1.2 CREATE LOGICAL UNIT DESCRIPTION (CRTLUD)

The Create LUD template must be initialized as follows:

FIELD NAME	ENTRY
LUD Type:	'00'C
Device Type:	'CONS'C
Model Number:	'40404040'X or '/////C
Physical Address (LUD OU#):	'0002'X
Power Control:	'0000'X
Session Definition Data:	all binary zero
Load/Dump Indicator:	all binary zero
Specific Characteristics	
Length:	'0000'X
Retry Value Length:	'0000'X
Error Threshold Length:	'0000'X
Device Specific Contents	

Length:	'0000'X
Device Specific Modify	
Length:	'0000'X

4.1.3 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

The following is a list of functions the system console supports through the MODLUD instruction.

```
VARY ON
VARY OFF
ACTIVATE
DEACTIVATE
SUSPEND
QUIESCE
RESET
RESUME (Activate after suspend, quiesce or
reset)
```

Refer to the Modify LUD Instruction for the meaning and use of each function.

In addition to the possible QUIESCE failure conditions described under MODLUD for all devices, the console QUIESCE will fail under the following two situations:

If a RD MOD is outstanding at the time the QUIESCE is received, or if one of the subsequent REQIOs encountered while handling the QUIESCE is a RD MOD, the MODLUD (quiesce) will terminate with a S/S Resource Not Available exception. See Section 4.1.5.2.

If the console is in terminating mode at the time the QUIESCE is received, or if one of the subsequent REQIOs encountered while handling the QUIESCE has an error causing the console to enter terminating mode, the MODLUD (quiesce) will terminate with the Resource Not Available exception. See Section 4.1.5.2.

4.1.4 REQUEST I/O INSTRUCTION (REQIO)

The REQIO instruction is used to send I/O requests to the device. A source/sink request (SSR) is always associated with the REQIO. The source/sink data (SSD) associated with most SSRs is not always required and is discussed as it applies to each type of console request. A feedback record (FBR) containing information about the execution of the request is posted for each REQIO successfully issued.

4.1.4.1 Source/Sink Request (SSR)

The SSR for a REQIO to the console contains the following values:

S/S Object	Pointer to LUD
Response Queue	Pointer to Response Queue
S/S Data Area (SSD)	Space Pointer
Optional Pointer	Reserved (binary zero)
Request Priority	See Volume III S/S REQIO
Request ID	See Volume III S/S REQIO
Function Field	'80'X (any '8n'X value will be accepted)
Control Field	'N' or 'C'
Key Length	Bin(2)
Key Offset	Bin(2)
RD Count	1 (Except REQIO - Continue)
RD Offset	Bin (2)

The RD count field specifies the number of 16 byte request descriptor fields associated with the REQIO. The system console supports only one (1) RD per REQIO. The valid RD counts are:

Control-Field	RD-Count-
'C'	'0000'X
'N'	'0001'X

The RD Offset field indicates the offset from the start of the SSR to the 16-byte RD. The S/S Data area (SSD) pointer points to the data being transferred to/from the console corresponding to the command in the RD.

The format of the 16-byte RD is as follows:

Byte 0	Command	Char(1)
	'01'X - WRITE	
	'04'X - CONTROL	
	'05'X - WRITE with CONTROL	
	'12'X - READ MODIFIED	
	'22'X - READ BUFFER	
	'44'X - CANCEL	
Bytes 1-6	Command Modifier	Char(6)
Bytes 1-2	Control Value	Char(2)
Bits 0-4	Reserved (binary zero)	
Bit 5	Erase Screen	
Bit 6	Erase Unprotected Fields	
Bit 7	Reset Modified Data Tags	
Bits 8-9	Reserved (binary zero)	
Bits 10-11	Keyboard	
	'00'-Unchanged	
	'10'-Lock	
	'01'-Unlock	
	'11'-Unlock	
Bits 12-13	Alarm	
	'00'-Unchanged	
	'10'-On	
	'01'-Off	
	'11'-Off	
Bits 14-15	Attention Light	
	'00'-Unchanged	
	'10'-On	
	'01'-Off	
	'11'-Off	
Byte 3	Pre-Command Control	Char(1)
Bits 0-1	Reserved (binary zero)	

Bits 2-3	Keyboard (pre-command)
	'00'-Unchanged
	'10'-Lock
	'01'-Unlock
	'11'-Unlock
Bits 4-7	Reserved (binary zero)
Bytes 4-6	Reserved (binary zero)
Bytes 7-9	Reserved (binary zero)
Bytes 10-11	Data Length
Bytes 12-15	Reserved (binary zero)
	Char(3)
	Char(3)
	Bin(2)
	Char(4)

The command byte is used to specify the exact function to be performed during the execution of the REQIO. Valid commands are READ, WRITE, CANCEL, CONTROL, and WRITE with CONTROL. The last three bits of the command byte are used to specify the command as shown in Figure 4.1.4.1-A.

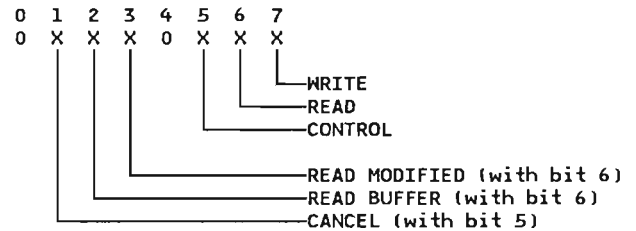


Figure 4.1.4.1-A Command Field Encoding

Because the system console can perform two different READ functions, bit 2 or 3 of the command byte is used along with bit 6 to identify which function is being requested. A special control function, to cancel an outstanding READ MODIFIED that has not completed, is specified with the combination of bits 1 and 5. All possible valid values were shown above.

The command modifier bytes are used to control various characteristics of the console. The control value field is used only when Control is specified (ie, the Control, Write with Control) and must otherwise be binary zero.

When combined with a WRITE command, the control functions specified in the first byte of the control value field are performed before the write operation and the control functions specified in the second byte are performed after the write operation.

The erase screen function signifies a request to erase the screen in preparation for writing a new format and data. Because this function causes the entire display buffer to be filled with blanks, all field attributes and data are lost. An error will occur if the display buffer is left in this undefined state containing no field attributes. Therefore, this erase function should be requested only on a WRITE with CONTROL command that will transmit the appropriate characters to reformat the screen.

The erase unprotected fields function causes all input fields (fields with the attribute byte specifying unprotected) to be filled with blank characters ('40'X). That is, any nonblank characters contained in these fields are effectively erased, (replaced with blanks).

The reset modified data tags (MDT) function causes the modified data tag in all field attribute characters to be reset. This function is used to condition the input fields so that completion of a READ MODIFIED results in the transfer of only those fields modified by the operator in the interim.

The bits of the second byte in the control value field are used in pairs to provide control over the hardware features of the console. The keyboard field is used to specify that the keyboard should be locked or unlocked. A locked keyboard means that all keys are inoperative except the system request key. The operator is unable to key data into the display buffer. This is visibly apparent as the cursor disappears when the keyboard is locked. The audible alarm at the console can be turned on or off by setting the alarm field to the appropriate values. The attention indicator light on the console is controlled in a similar manner using the attention light field.

The pre-command control field is valid only when a READ MODIFIED is specified. The field allows keyboard control before the READ MODIFIED operation.

With a WRITE command, the data length field specifies the number of bytes of data to be transferred from the SSD to the console. On a READ command, the data length indicates the maximum number of bytes of that can be placed into the SSD, that is, the size of the user's input buffer.

WRITE Operation

The WRITE command causes data to be transferred from the SSD to the console display buffer. The data stream can contain special buffer control information along with the field attribute characters and displayable data that is written into the display buffer. By properly constructing the data stream, a single WRITE command can be used to define formatting fields, display messages in scattered locations on the screen, and position the cursor. Data stream formats are discussed in the description of the SSD in Section 4.1.4.2.

READ BUFFER Operation

The READ BUFFER command causes the entire contents of the display buffer to be transferred to the SSD.

This command is normally used to save the entire buffer contents so that the same display format and displayable data can be restored at some later time (in an error situation, for example).

READ MODIFIED Operation

Operation of the READ MODIFIED command is somewhat different than the other commands discussed. A REQIO specifying a READ MODIFIED command signifies that the program is ready to accept data from the console and a data area has been provided into which the data can be transferred. The actual transfer of data and completion of the request does not occur until the console operator presses one of the function keys (the ENTER, ROLL UP, ROLL DOWN, HELP, SYS REQ, or one of the CF (Control Function) keys).

This command does not cause immediate data transfer and it does not necessarily complete in sequential order if followed by other REQIO instructions (that is, a WRITE following the READ MODIFIED could complete before the READ MODIFIED as described later in this section).

The data stream that is transferred when this command is executed includes the address of the cursor, identification of which function key was pressed, and the address and contents of all fields that have the modified data tag (MDT) on in the field attribute character. The first field following row 0 and column 0 that has an attribute byte with the MDT bit on will be the first field in the data stream.

On the console, a READ MODIFIED is always issued to the hardware by the IOM within 2 seconds after a Request I/O is completed. This allows the operator to interrupt the system by depressing the SYSTEM REQUEST key on the console. Subsequently, the IOM signals a Supervisory Service Request event which in turn allows the user to issue a Request I/O which will provide a SYSTEM REQUEST MENU to the operator.

The keyboard will be locked or unlocked upon receipt of a READ MODIFIED depending on the values in the pre-command control field. Locking the keyboard before the READ MODIFIED will cause the operator response to be limited to pressing the system request key. Completion of a READ MODIFIED without CONTROL will cause the keyboard to be locked.

If the keyboard is unlocked and there is no outstanding READ MODIFIED, the hardware will accept any operator keying actions up to the depression of one of the function keys. At that point, the keyboard will lock. If the next command received by the console is a READ MODIFIED, it will complete immediately with the buffered data. If any other command is received, the data will remain in the display buffer with the MDT bits on and the new command will be processed. A subsequent CONTROL command may turn off the MDTs and a keyboard unlock would cause the function key identity to be lost, however.

CANCEL Operation

The CANCEL command is used only to request the return of an uncompleted READ MODIFIED request. Depending on the relative timing of the CANCEL request and the operator pressing the ENTER key, two states may exist:

- The cancel cancels the read modified.
- There was no read modified outstanding for the cancel to cancel (it may have completed and returned an FBR just before the cancel was received).

As shown below, the error summary values in the cancel FBR clearly indicate which event occurred.

<u>State</u>	<u>Error Summary in</u>	
	<u>RD-MOD</u>	<u>Cancel</u>
RD MOD Canceled	4014	0000

No RD MOD outstanding N/A

5014

The command modifier and the data length fields are not used with a CANCEL request and must be binary zero.

WRITE with READ MODIFIED Outstanding

A READ MODIFIED request does not need to be canceled to update displayed messages using a WRITE command.

Should a WRITE be received while there is an outstanding READ MODIFIED, the machine will CANCEL the READ MODIFIED, issue the WRITE to the console and then reinstate the READ MODIFIED request. Care should be taken to ensure that the WRITE data stream does not overlay those portions of the screen being used by the operator to key in data. The WRITE must also put the keyboard lock back into the state needed for the READ MODIFIED.

CONTROL Operation

The CONTROL command can be coded independently of reads and writes to enable the user to control the various mode settings of the console. CONTROL may also be used in conjunction with reads and writes as previously discussed.

Sequencing Operations

It is possible for the user to issue multiple commands to the console without having to dequeue the FBR between each. Once the console has started working on a command, it will not receive another command until the first has completed and the FBR is posted. The only exception to this is the READ MODIFIED. Because of its nature, it must be possible to CANCEL the READ MODIFIED or WRITE data on the screen while the READ MODIFIED is pending and the operator is entering data. Therefore, it must be possible for the console to receive either a CANCEL or WRITE command. If any other command is received, it will be flagged with a sequencing error and the FBR for it will immediately be returned to the user. Because of the variability of the operator hitting enter, this may not always occur.

4.1.4.2 Source/Sink Data (SSD) Area

The SSD specified in a REQIO instruction is a user I/O buffer either containing RIUs to be transferred with a WRITE command or receiving the RIUs transferred with a READ command. (The console defines an RIU as one byte.) These I/O buffer areas should preferably be double word aligned for performance considerations. For WRITE operations, if the buffer is not double word aligned, the data will be moved into an internal buffer before processing begins to the device. On READ operations the data received from the device is always buffered internally during processing and then moved out to the user's I/O buffer. The data streams transferred or received will be discussed here for each command.

WRITE Data Stream

The data stream for a WRITE command must contain buffer control orders along with the characters that are to be written into the display buffer. Each WRITE data stream must begin with a set buffer address (SBA) control order to specify where writing of data into the buffer should begin. The SBA order is a X'11' immediately followed by a 2-byte row/column address of the desired position on the screen. The first address byte can assume values from 0 to 15 (X'00' to X'0F') to select one of the 16 lines where data can be displayed. The second address byte has a valid range of values from 0 to 63 (X'00' to X'3F') identifying one of the 64 columns (or horizontal display positions). Thus, a data stream to start writing in the first buffer location (upper left corner of the screen) would specify '110000'X followed by the data to be written into the display buffer at that position. Multiple SBA orders can be included in the data stream to write data at scattered locations in the buffer. If fields are overlapped, the last SBA will take precedence. The console will support a maximum write data stream length of 2048 bytes.

The position of the cursor is controlled by the user, by including an Insert Cursor (IC) control order in the data stream. The IC order is a X'13' and causes the cursor to be inserted at the current buffer address. The IC order does not cause the buffer address to be incremented. The cursor can be inserted, and the following character written, into the same display buffer location.

A Repeat thru Address control order causes a character to be propagated through an entire field. The control order is a X'02' immediately followed by a 2-byte target address (row/column) and the hexadecimal value to be propagated from the current buffer location up to, and including, the target address location.

In addition to building a data stream containing buffer control orders and displayable data, the user is also responsible for formatting the display screen. A field in the display buffer is defined as a field attribute character followed by all characters up to the next field attribute character. These attribute characters are nondisplayable, unalterable, characters occupying one position in the buffer and appearing as blanks on the screen. The attributes specified by the field attribute character apply to all the following positions until the next attribute character is encountered. Due to automatic address wrap at the end of the display buffer, one attribute character in any position will serve to define the entire buffer as a single field.

The format of the attribute character and the individual bit assignments are shown in Figure 4.1.4.2-A. The attribute character for a non-underlined, unprotected, displayable field that has not been modified is, for example, a X'20'.

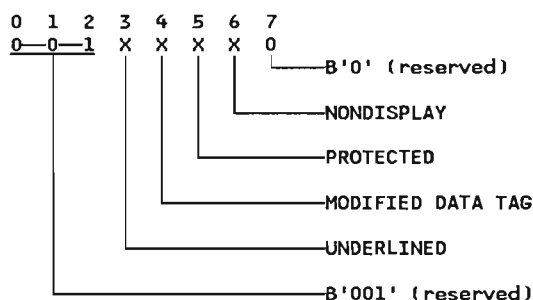


Figure 4.1.4.2-A Field Attribute Character

All combinations of attributes are valid, although some combinations would probably not be used. For example, if underline and nondisplay are specified, the characters are not displayed but the underline is. As another example, a protected field can be created with the MDT bit on, in which case the operator cannot update the field, yet a READ will pass the field back to the user.

The user must ensure that there is always at least one attribute character on the screen (one field defined).

If the write data stream contains any unprintable characters (ie, X'00') the hexadecimal value will be displayed on the screen. The data will not be altered and will be read back as its original value.

There are four ways the write data stream can be built, which will cause an error. In each case, the console buffer will be partially updated and the first byte of the control value field will have been processed. Therefore, for an Invalid screen format error, the programming system should recreate the entire screen buffer before continuing. The four causes are:

- Failure to begin the write data stream with an SBA.
- Ending the data stream with a '11'X (not enough bytes for all three bytes of the SBA).
- Ending the data stream with a '02'X (not enough bytes for all four bytes of the Repeat Through Address).
- A write data stream which results in a screen buffer with no attribute byte.

Read Buffer Data Stream

The 1027 byte data stream which is transferred on a Read Buffer consists of:

Bytes 0-1	Cursor Location	Char(2)
Byte 2	Keyboard Status	Char(1)
Bits 0-1	Reserved (binary zero)	
Bits 2-3	Keyboard	
	'10' - Locked	
	'01' - Unlocked	
Bits 4-5	Alarm	

Bits 6-7 '10' - On
 '01' - Off
 Attention Light
 '10' - On
 '01' - Off

Bytes 3-1026 Display buffer contents Char(1024)

The READ BUFFER data stream will be truncated if the record length in the SSR is less than 1027. Also, note that the keyboard status byte can be used directly in the second byte of the control value field of the SSR to recreate the state of the console at the time the READ BUFFER was executed.

Read Modified Data Stream

Completion of the READ MODIFIED command is controlled by the operator. When the operator presses an ENTER, CF, SYSTEM REQUEST, HELP, ROLL UP or ROLL DOWN Key, the following information is included in the data stream.

Byte 0	Function Key ID	Char(1)
Bytes 1-2	Cursor Location (row/column)	Char(2)
Bytes 3-5	SBA (of first field with MDT on)	Char(3)
•	Data from that field	Char(*)
•	SBA (of next field with MDT on)	Char(3)
•	Data from that field	Char(*)
•	(and so on, for all fields with MDT on in the attribute byte)	•

The length of the data stream transferred is specified by the RIU Segment Count field in the FBR. The possible values of the function key ID are as follows:

'F1'X - ENTER	'F3'X - HELP
'F4'X - ROLL DOWN	'F5'X - ROLL UP
'FC'X - SYSTEM REQUEST	'B1'X - CF13
'31'X - CF1	'B2'X - CF14
'32'X - CF2	'B3'X - CF15
'33'X - CF3	'B4'X - CF16
'34'X - CF4	'B5'X - CF17
'35'X - CF5	'B6'X - CF18
'36'X - CF6	'B7'X - CF19
'37'X - CF7	'B8'X - CF20
'38'X - CF8	'B9'X - CF21
'39'X - CF9	'BA'X - CF22
'3A'X - CF10	'BB'X - CF23
'3B'X - CF11	'BC'X - CF24
'3C'X - CF12	

If the function Key which has been depressed is either HELP or SYSTEM REQUEST, then a RIU Segment Length of 3 is returned in the Feed Back Record. If the function key was any other, the fields, with the MDT on, follow in order.

If no fields have been modified, the data stream consists only of the function key ID and the cursor location. However, space should be provided in the specified data area for the maximum amount of data that could be transferred (that is, the sum of the lengths of all unprotected fields plus the necessary control and address bytes). The maximum 'possible' data stream that could be returned (every display position an attribute byte) is 4099 bytes.

Control Data Area

No data area need be reserved for use with CONTROL only commands, because the control functions involve no data transfer.

Cancel Data Area

No data area need be reserved for use with CANCEL commands, as there is no data transfer.

4.1.4.3 Feedback Record

The feedback record (FBR) is the vehicle for signaling to the program that the functions requested in a REQIO instruction have completed, and whether they completed successfully or not.

The format of the feedback record is as follows:

Bytes 0-15	SSR Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for descriptions of the SSR Address and Request ID fields.

The error summary field defines the status of the REQIO as generically defined in the REQIO instruction description. The specific values possible for the console are itemized in Table 1 which follows.

The RD number is the index of the last RD processed or the RD in error if an error is indicated. For the console, the RD number will always be one.

The RIU segment count is the number of bytes transferred to the SSD by this request.

The device dependent area is all binary zero unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction.) If the device dependent data is present, the fields have the following definitions.

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered. This code is also provided as event related data on the LUD failure event for those cases where the event is also signaled. The possible values are shown in Table 1 and further information is present in Pacific Hardware Functional Specification.

The time stamp and OU# are the same values present in the hardware error log entry and are used to correlate the FBR and the error log entry for maintenance purposes.

Table 1: Console Error Summary Values

Error Summary	Dev Dep Err Code	Hardware Err Code	Meaning	Recovery
X'0000'	N/A	N/A	Normal completion	N/A
X'0008'	N/A	N/A	REQIO Continue	N/A
X'4009'	N/A	N/A	REQIO partially complete--MODLUD (reset)	Issue activate to proceed or deactivate to destroy session
X'400A'	N/A	N/A	REQIO not done MODLUD (reset)	Issue activate to proceed or deactivate to destroy session
X'4014'	N/A	N/A	Read Modified canceled (on the read MOD)	N/A
X'C041'	N/A	N/A	SSD destroyed	Provide a correct SSD, perform any higher level recovery required for data which may have been lost, then, reissue REQIO and issue a REQIO-continue
X'C044'	N/A	N/A	Read data truncated due to insufficient buffer space	If MDTs were not reset, correct problem, perform any higher level recovery required for data which may have been lost, then reissue command
X'5014'	N/A	N/A	Cancel command incomplete because read modified was already completed	N/A
X'C00B'	N/A	N/A	IOM Partial Damage	LUD must be varied off to clear this condition. A partial damage event has also been signaled.
X'C010'	N/A	N/A	OU Task failure	LUD must be varied off and varied back on again
X'C045'	N/A	N/A	SSD data stream too large on a write	Correct RD, reissue REQIO and issue REQIO-continue
X'C086'	N/A	N/A	Invalid RD Count	Correct problem, reissue issue REQIO and issue REQIO continues
X'C087'	N/A	N/A	Invalid RD Command or command modifier or reserved fields set wrong	Correct RD, reissue REQIO and issue REQIO - continue
X'D080'	N/A	N/A	Command out of sequence. Read commands only.	Issue REQIO - continue and correct problem
X'E015'	X'0001'	X'0101'	I/O Error - Channel Error or OU task failure	Not correctable, seek hardware assistance. The LUD failure event is also signaled for these cases.
		X'0201'	- CRT cable out	
		X'0202'	- KBD cable out	
		X'0203'	- Screen buffer parity	
		X'0204'	- Screen buffer and DBI parity	
		X'0205'	- KBD Overrun	
		X'0206'	- Invalid KBD scan	

Table 1: Console Error Summary Values

Error Summary	Dev Dep Err Code	Hardware Err Code	Meaning	Recovery
X'E015'	X'0002'	X'0301'	code	Not correctable, seek software assistance
		X'0302'	- Post event	
		X'0401'	- Invalid Dis-connect	
		X'0402'	- Invalid BSTAT/DSTAT data	
X'E015'	X'0003'	X'0105'	- FOB Timeout	Correct problem, rewrite entire screen, reissue REQIO and issue REQIO - continue
		X'0403'	- I/O Error	
		X'0104'	- CMD reject	
			- OP PGM error	
X'E015'	X'0003'	X'0104'	I/O Error	Correct problem, rewrite entire screen, reissue REQIO and issue REQIO - continue
			- Invalid screen format	

Table 2: Feedback Error Summary by RD Command

RD Commands							
'01'X	Write						
'04'X	Control						
'05'X	Write With Control						
'12'X	Read Modified						
'22'X	Read Buffer						
'44'X	Cancel						
Feedback		C O M M A N D					
Error Summary	01	04	05	12	22	44	
4014				X			
C044				X	X		
5014						X	
C045	X		X				
D080				X	X		
E015 0001	X	X	X	X	X	X	
E015 0002	X	X	X	X	X	X	
E015 0003	X		X				
All							
Other							
Errors							A N Y C O M M A N D

State of the Console After an Error

Error summary values over '8000'X must be followed by one of the following commands in order to clear the error condition:

REQIO-Continue
MODLUD-Reset

In addition:

- C010 - Console is in failure mode and must be varied off and varied back on before it can be functionally used again.
- E015 - (Device Dep Code 0001 & 0003)--State of the console is unknown and if the user wishes to continue, the entire screen and control states should be rewritten.
- All Others - Console is restored to the state it was in before the erring command was issued. Only REQIO-Continue may be needed to resume use (see above).

Cancel

If the user is attempting to CANCEL a READ MODIFIED it is possible that a device error could occur on the command. If the console detects a device error on the READ MODIFIED retry will be done and the value in the error summary field of the READ will indicate the error. The error summary field in the CANCEL will indicate normal completion or cancel incomplete (X'0004').

WRITE with READ MODIFIED

This command involves the console cancelling the outstanding READ MODIFIED, executing the WRITE and then reissuing the READ MODIFIED. If the WRITE FBR is returned with an error summary field indicating invalid RD count or invalid command field, the READ MODIFIED will not have been canceled and would still be outstanding. If the error summary field indicates any other type of error the READ MODIFIED will have been canceled but not reexecuted. The console will have to receive a REQIO - continue before it will reexecute the READ MODIFIED. It is possible that the READ MODIFIED can complete before it can be canceled. If it completes with a device error, the WRITE will not be executed until the console receives a CONTINUE.

4.1.5 EVENTS AND EXCEPTION CODES

4.1.5.1 Events

The following events are also signaled by CONSOLE device management. For a complete description of the following events, see Chapter 8 of this document.

LUD Supervisory Service Request Event : (000B 04 01)

This event is signaled by the machine whenever a READ MOD is completed by the operator depressing the SYSTEM REQUEST key. No additional event data is supplied for this event.

LUD Contact Event : (000B 06 01,02)

This event is signaled when the LUD vary on processing is completed by the MSCP. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details. Subtype 01 is signaled upon successful contact, however, subtype 02 (unsuccessful case) is never signaled for the console. In these cases, the MODIFY LUD (VARY ON) instruction signals an exception instead.

LUD Failure Event : (000B 08 01)

This event will be signaled if a device failure has occurred which prevents use of the console until the problem is corrected. The event will be signaled for any errors that have a recovery action of calling a CE.

The variable event data consists of:

Bytes 0-1	Hardware Error Code. See Table I of Section 4.1.4.5 for a list of these error codes meanings and the appropriate error recovery action. The codes which appear under error summary code E015 0001 are the only ones which cause this event to be signaled.
Bytes 2-9	Error Log Timestamp.
Bytes 10-11	OU Number = '0002'X.
Bytes 12-13	Optional Data = Not Used.

REQIO Complete Event (000B 09 01)

This event will be signaled if the user requests it. See the REQIO instruction for details.

REQIO Response Queue Destroyed Event : (000B 0A 01)

This event is signaled if the user truncates or destroys the Request I/O Response Queue while the machine is processing REQIOs.

due to a READ
MODIFIED command
being out-
standing.

Quiesce Session '2313'X '1301'X

Quiesce rejected
due to a READ
MODIFIED command
being out-
standing.

'1302'X

Quiesce rejected
due to a
terminating
error condition
existing.

4.1.5.2 Exception Codes

The following table provides a summary of the cases where the S/S Resource Not Available exception ('3404'X) will be signaled when a MODIFY LUD instruction is executed for the console LUD.

<u>COMMAND</u>	<u>GENERIC</u>
----------------	----------------

Suspend Session '2312'X '1201'X	Suspend rejected
---------------------------------	------------------

The 3404 exception is not signaled for the modify operations--VARY ON, ACTIVATE, or RESUME--for the console LUD. If any hardware failures have occurred, these have been reported via the LUD failure event, and will conditionally cause further REQIO instructions to fail, but the LUD state changes will be allowed.

4.2 5424 MULTIFUNCTION CARD UNIT

The 5424 device is a 96 column card read/punch/print device.

4.2.1 PROGRAMMING CONSIDERATIONS

The basic object of control is the Logical Unit Description (LUD). All references to a device are made with respect to the LUD. The CREATE, MODIFY and DESTROY LUD MI instructions establish and control the environment in which the MFCU operates. The REQIO MI instruction controls the device and causes it to read, feed, punch and print cards.

Following a power up, and before requests for I/O operations can be accepted, several steps must have occurred.

1. A LUD must have been created through the use of the CREATE LUD instruction.
2. The MFCU must have been varied on through the use of the modify LUD instruction.
3. The MFCU must be made active through the use of the Modify LUD instruction.

4.2.2 CREATE LOGICAL UNIT DESCRIPTION (CRTLUD)

The identified fields in the CREATE LUD template must be initialized for the MFCU as follows:

FIELD NAME	ENTRY
LUD Type:	'00'C
Device Type:	'5424'C
Model Number:	Choose One (' A1', ' K1', * ' K2', ' A2', or ' K3')C *
Physical Address (LUD OU#):	'0019'X
Power Control:	'0100'X
Session Definition Data:	all binary zero
Load/Dump Indicator:	all binary zero
Specific Characteristics Length:	'0000'X
Retry Value Length:	'0000'X
Error Threshold Length:	'0000'X
Device Specific Contents Length:	'0000'X
Device Specific Modifiable Length:	'0000'X

* - For models K1 and K3 the MFCU IOM provides KATAKANA features. The IOM translates from revised KATAKANA card code format to Standard KATAKANA EBCDIC on output. The MFCU IOM also translates the Standard KATAKANA EBCDIC to revised KATAKANA card code.

4.2.3 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

The following is a list of functions the MFCU supports through the MODLUD instruction.

POWER ON
POWER OFF
VARY ON
VARY OFF
ACTIVATE
DEACTIVATE
SUSPEND
QUIESCE
RESET
RESUME (Activate after Suspend, Quiesce, or Reset)

Refer to the Modify LUD Instruction for the meaning and use of each function. The MFCU device has 1 special programming consideration with regard to use of the MODLUD (RESET) operation. If the MODLUD(RESET) is issued while any Request I/O operations are still pending within the machine, this reset operation will take approximately 11 seconds to complete in order to ensure that the device can be halted without leaving cards within the transport. If no Request I/O operations are pending, the reset operation completes normally.

4.2.4 REQUEST I/O INSTRUCTION (REQIO)

The REQIO instruction is used to send I/O requests to the device.

The SSR for a REQIO to the MFCU contains the following values:

S/S Object	-	Pointer to MFCU LUD
Response Queue	-	Pointer to Response Queue
S/S Data Area	-	Space Pointer
Optional Pointer	-	Reserved (binary zero)
Request Priority	-	See Volume III S/S REQIO
Request ID	-	See Volume III S/S REQIO
Function Field	-	'80'X
Control Field	-	'N' or 'C'
Key Length	-	Bin(2)
Key Offset	-	Bin(2)
RD Count	-	Bin(2)
RD Offset	-	Bin(2)

The MFCU supports multiple Request Descriptors (RDs) in a REQIO SSR. The RD offset field indicates the offset from the start of the SSR to the first 16 byte RD. The number of RDs is specified by the RD count field. An RD represents a command to the MFCU hardware to operate on one or more cards. The data representing one card is called a segment and the segment count field indicates the number of cards to be processed by this RD.

The SSD space pointer identifies a contiguous data area comprising, in the order processed, the segments within an RD for the RDs within the SSR. The size of the area needed is the sum over each RD of (number of bytes per segment) X (number of RIU segments specified in the RD). The SSD space has no

boundary alignment requirements since all data is internally rebuffered by the machine.

The format of the RD is as follows:

Byte 0	Command	Char(1)
	'14'X - Feed	
	'02'X - Read	
	'11'X - Punch	
	'21'X - Print 3 Lines	
	'61'X - Print 4 Lines	
	'13'X - Read and Punch	
	'23'X - Read and Print 3 Lines	
	'63'X - Read and Print 4 Lines	
	'31'X - Punch and Print 3 Lines	
	'71'X - Punch and Print 4 Lines	
	'33'X - Read, Punch and Print 3 Lines	
	'73'X - Read, Punch and Print 4 Lines	
Bytes 1-6	Command Modifier	Char(6)
Byte 1		Char(1)
Bit 0	Select Feed Path	
	0 = Primary feed path	
	1 = Secondary feed path	
Bit 1	Stacker Select	
	0 = Default stacker (chosen based upon the operation to be performed--see System/38 Hardware Functional Specification, Volume IV-A, Section 8)	
	1 = Stacker number specified in following two bits	
Bits 2-3	Stacker Number	
	00 = Stacker 4	
	01 = Stacker 1	
	10 = Stacker 2	
	11 = Stacker 3	
Bits 4-7	Reserved (binary zero)	
Byte 2	Multi-Use Data (MUD) Field	Char(1)
	0 = each function within the command uses a separate data field in the data area	
	3 = fields 2 and 3 are the same field	
Bytes 3-6	Reserved (binary zero)	Char(4)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Segment Count	Bin(2)
Bytes 10-11	Segment Length	Bin(2)
Bytes 12-15	Reserved (binary zero)	Char(4)

The command field indicates the type of operation to be performed. The specific commands are described later.

The command modifier field byte 1 is used to control the feed path and stacker as specified above. The MUD field specifies the use of the data fields within the data area. Field 1 is the read field, field 2 is the punch field and field 3 is the print field. If the command includes print 4 lines, the specified MUD is ignored and it defaults to MUD=0. Command Modifier bytes 3, 4, 5, 6, and 7 are reserved. Some examples of the use of the MUD field follow.

Example 1: CMD = '33'X (Read, Punch and Print)
MUD = 0

FLD 1	FLD 2	FLD 3
READ DATA	PUNCH DATA	PRINT DATA
96 bytes	96 bytes	96 bytes

Example 2: CMD = '33'X (Read, Punch and Print)
MUD = 3

FLD 1	FLD 2 & 3
READ DATA	PUNCH DATA PRINT DATA
96 bytes	96 bytes

Example 3: CMD = '31'X (Punch and Print)
MUD = 3

FLD 2 & 3
PUNCH DATA PRINT DATA
96 bytes

If the command is one of the following types:

'13'X - Read and punch
'23'X - Read and print 3 lines
'63'X - Read and print 4 lines
'33'X - Read, punch and print 3 lines
'73'X - Read, punch and print 4 lines

The MFCU IOM will only process the RD contained in the above command and will not process the remaining RD's in the REQIO if there is any. The MFCU IOM will also indicate in the Feedback record that the number

of RD's completed per REQIO is equal to the RD containing the above command plus any previous RD's which have other types of commands.

The RIU Segment Type field must be '00'X for the MFCU. This indicates that the RIU segments are contiguous in the SSD and that there are no gaps or control characters between segments in the SSD data area.

The Segment Count field contains the number of cards to process. The range is 1 through 32767. If 0 is specified, 1 record will be processed.

The Segment Length field is the total number of bytes to be read, and/or punched, and/or printed on a single card. This field contains the summation of the data field lengths for each function to be performed. The punch and/or read functions are assumed to be 96 characters in length. The print operation is either 96 or 128 characters in length depending on whether the command is a 3 or 4 line print. Some examples to show the RD and data areas follow.

Example 4:

The following example shows the RD and Data Area to read 5 records of 96 bytes each.

RD:

CMD	MUD	RESV	SEGMENT COUNT	SEGMENT LENGTH	RESV
02	0		5	96	

Source/Sink Data Area:

96 BYTES	96 BYTES	96 BYTES	96 BYTES	96 BYTES
----------	----------	----------	----------	----------

Example 5:

The following example shows the RD and DATA AREA to PUNCH and PRINT 3 cards with the same data.

RD:

CMD	MUD	RESV	SEGMENT COUNT	SEGMENT LENGTH	RESV
31	3		3	96	

Source/Sink Data Area:

96 BYTES	96 BYTES	96 BYTES
----------	----------	----------

Example 6:

The following example shows the RD and Data Area to punch and print different data into one card and read the next card.

RD:

CMD	MUD	RESV	SEGMENT COUNT	SEGMENT LENGTH	RESV
33	0		1	283	

Source/Sink Data Area:

READ DATA	PUNCH DATA	PRINT DATA
96 BYTES	96 BYTES	96 BYTES

FEED

The feed request moves a card from the specified hopper to the corresponding wait station.

An error in feeding a card will cause a summary status of unrecoverable I/O error to be returned and the appropriate device dependent bits turned on.

READ

The read request moves a card from the specified hopper to the corresponding wait station. The data contained in all 96 columns of the card is transferred to the address specified by the data area. The data read is checked to ensure that it is read correctly.

An error during reading causes an error summary of unrecoverable error to be returned, and the appropriate device dependent status bits on.

PUNCH

Request I/O instructions that specify punching initiate moving a card from one of the wait stations, through the punch station and transport, and to the stackers. As the cards pass through the punch station, data from the punch data area is recorded in them in the form of punched holes. The punching is checked to ensure that the correct data is punched.

An error during a punch operation causes an error summary unrecoverable error to be returned, and the appropriate device dependent status bits on.

PRINT

Request I/O instructions that specify print initiate card motion from the selected wait station, through the punch and cornering stations, and into the print station where three or four lines of 32 characters each are printed on the card.

The 96 or 128 byte print data area is printed on the card in the following manner:

Line 1 - Leftmost address to byte 32
 Line 2 - Bytes 33 through 64
 Line 3 - Bytes 65 through 96
 Line 4 - Bytes 97 through 128 if the fourth line is specified

The MFCU prints any of the allowable characters (see the System/38 Hardware Functional Specification, Volume IV-A, Section 8 for details). Any of the characters that are not included in this set print as blanks without causing an error.

An error during a print operation causes an error summary of unrecoverable error to be returned in the feedback record and the appropriate device dependent status bits on.

COMBINED OPERATIONS

Request I/O specifying combined operations proceed in the same manner described for individual operations except that one card is fed from the wait station, punched into and/or printed on before stacking. The next card is fed from the specified hopper into the wait station during punching. If read was specified, the data in the card is read into storage.

4.2.4.1 Feedback Record and Error Recovery Procedure

The format of the feedback record is as follows:

Bytes 0-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Char(2)

Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU Number	Char(2)
Bytes 38-39	BSTAT	Char(2)
Bytes 40-47	DSTAT	Char(8)
Bytes 48-63	Reserved	Char(16)

See the REQIO instruction for descriptions of the Request Address and Request ID fields.

The error summary field defines the status of the REQIO as generically defined in the REQIO instruction description. The specific values possible for the MFCU are itemized in the following table.

The RD number is the index of the last RD processed or the RD in error if an error is indicated.

The device dependent area is all binary zero unless the presence of device dependent data is indicated by the error summary value. If the device dependent data is present, the fields have the following definitions.

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered. The possible values are shown in Table 1 and further information is present in Pacific Hardware Functional Specifications.

The time stamp and OU# are the same values present in the hardware error log entry and are used to correlate the FBR and the error log entry for maintenance purposes.

The BSTAT and DSTAT are the corresponding basic status and device status resulting from the error condition.

The following table lists the device dependent status codes, what caused the problems, and the recommended recovery action.

Table 1.

Error Summary	Dev Dep Err Code	Hardware Err Codes	Meaning	Recovery Action
X'0000'	N/A	N/A	Normal Completion	N/A
X'0008'	N/A	N/A	REQIO continue response	N/A
X'C009'	N/A	N/A	Partially processed request terminated due to reset session	Activate must be issued to restart processing or a MODLUD Reset followed by deactivate must be issued to destroy the session
X'C00A'	N/A	N/A	Unprocessed request due to reset session	Activate must be issued to restart processing or a deactivate must be issued to destroy the session
X'C00B'	N/A	N/A	IOM Partial Damage	LUD must be varied off to clear this condition. A partial damage event has been signaled.
X'C016'	N/A	N/A	End of File	A REQIO continue must be issued to restart processing
X'E041'	1001	N/A	SSD destroyed	Provide a proper SSD, perform any higher level recovery for data which may have been lost, then reissue REQIO and issue REQIO-continue.
	1002	N/A	SSD truncated or suspended	
	1003	N/A	SSD damaged	
X'C044'	N/A	N/A	SSD too small	Fix SSD, perform any higher level recovery for data which may have been lost, then reissue REQIO, issue REQIO continue.
X'C084'	N/A	N/A	Invalid pointer to SSD	Fix SSD pointer, reissue REQIO, and issue a REQIO continue to restart processing
X'C085'	N/A	N/A	Invalid function	Correct REQIO, reissue REQIO and issue REQIO continue
X'C087'	N/A	N/A	Invalid RD	Correct the RD, reissue REQIO and issue a REQIO continue
X'E010'	N/A	X'1916' Read Check X'1917' Punch Invalid X'1918' Punch Check X'191A' Emitter Check X'191F' Command Reject (Note 1) X'1980' Hopper Check	Retryable hardware errors	Check the DSTAT and BSTAT fields for error bits and determine appropriate recovery. A REQIO continue must be issued to restart processing.
X'E010'	X'0001'	X'1920' IOC-DBI Parity X'1921' IOC Parity X'1922' CSA Parity	Hardware parity errors	A CE should be called to repair the problem. The LUD failure event is also signaled.
X'E010'	X'0002'	X'1901' Feedcheck 1 X'1902' Feedcheck 2 X'1903' Feedcheck 3 X'1904' Feedcheck 4	Retryable hardware errors	Check the DSTAT and BSTAT fields for error bits and determine appropriate recovery. A REQIO continue must be issued to restart processing.

Note 1 The command reject code is presented in this retryable category for the case where the command is not a feed or read command and the wait station is empty for the path for which this command was issued (primary or secondary paths). For all other cases, command reject is a nonretryable error and is presented in the E010 0004 group.

TABLE 2 MFCU BSTAT and DSTAT

MFCU BSTAT

<u>Byte</u>	<u>Bit</u>	<u>Description</u>
0	0	Reserved for the channel
	1	Operation program error
	2	Halt
	3	Channel Error
	4	I/O exception
	5	Command Reject
	6	I/O Error
	7	Command complete
1	0	Power Fault
	1	Power on
	2	Reserved
	3	Hopper 1 empty
	4	Hopper 2 empty
	5	Stacker full
	6	End of data delimiter
	7	Reserved

MFCU DSTAT

<u>Byte</u>	<u>Bit</u>	<u>Description</u>
0	0-7	Same as BSTAT Byte 0 Bits 0-7 of previous command
1	0-7	Same as BSTAT Byte 1 Bits 0-7 of previous command
2	0	Hopper check
	1	Reserved
	2	Cover open error
	3-7	Feed check identifiers (hex values 01 through 14 correspond to feedchecks 1 to 20)
3	0	Cells defective
	1	Read check
	2	Reserved
	3	NPRO 1 required
	4	NPRO 2 required
	5	Punch invalid
	6	Punch check
4	7	Reserved
	0	Halt (same as DSTAT Byte 0 Bit 2)
	1	Disconnect
	2	Channel parity error
	3	Device address recognition out of sequence
	4	Fire emitter check
	5	Print sync check
	6	Print home check
	7	Print clutch check
	0	Stacker full
	1	Chip box full switch
	2	Cover switch
	3-4	Indicates which stacker was selected for last card to leave the transport 00 --> Stacker 4
5	5	Card in wait 2 (secondary path)
	6	Card in wait 1 (primary path)
	7	Motor ready 6
	0	
Reserved	1	Hopper cycle
	2-4	Reserved
	5-7	Cards in Transport count 7
Reserved (binary zero)		

TABLE 3: 5424 ERRORS BY RD COMMANDS

RD Commands (See Section 4.2.4)

'14'X - Feed
 '02'X - Read
 '11'X - Punch
 '21'X - Print 3 Lines
 '61'X - Print 4 Lines
 '13'X - Read and Punch
 '23'X - Read and Print 3 Lines
 '63'X - Read and Print 4 Lines
 '31'X - Punch and Print 3 Lines
 '71'X - Punch and Print 4 Lines
 '33'X - Read, Punch and Print 3 Lines
 '73'X - Read, Punch and Print 4 Lines

4.2.5.2 Exception Codes

The following table provides a summary of the cases where the S/S Resource Not Available exception ('3404'X) will be signaled when a MODIFY LUD instruction is executed for the MFCU LUD:

COMMAND	GENERIC	SPECIFIC CODE	
VARY ON	'2302'X	'0001'X	I/O failure has occurred. LUD failure event has been signaled.
ACTIVATE SESSION	'2303'X	None	Not signaled.
RESUME SESSION	'2311'X	None	Not signaled.
SUSPEND SESSION	'2312'X	'1203'X	Suspend rejected due to operator intervention condition

QUIESCE SESSION	'2313'X	'1302'X	existing.
		'1303'X	Quiesce rejected due to a terminating error condition existing. Quiesce rejected due to an operator intervention condition existing.
POWER ON	'2306'X	'0601'X	I/O device power failure. The LUD failure event has also been signaled.
POWER OFF	'2307'X	'0601'X	Same as above.

4.3 3262 AND 5211 PRINTERS

The 3262 or 5211 device is the primary printer on the System/38.

4.3.1 PROGRAMMING CONSIDERATIONS

The basic object of control is the Logical Unit Description (LUD). All references to a device are made with respect to the LUD. The CREATE, MODIFY, and DESTROY LUD MI instructions establish and control the environment in which the printer operates. The REQIO MI instruction controls the device and causes it to print data.

Before REQIO operations can be accepted, several steps must have occurred.

1. A LUD must have been created through use of the CREATE LUD instruction.
2. The printer must have been varied on through use of the MODLUD VARY ON instruction.
3. The LUD must have been made active through use of the MODLUD ACTIVATE instruction.
4. The device specific area must have been initialized through the use of the MODLUD (DSA) instruction. If this last step is not executed before attempting to print, a 'command reject' feedback record will be returned.

4.3.2 CREATE LOGICAL UNIT DESCRIPTION (CRTLUD)

The CREATE LUD template must be initialized as follows:

FIELD NAME	ENTRY
LUD Type:	'00'C
Device Type:	'5211'C
	or '3262'C
Model Number: For 5211 -	'0002'C
For 3262 -	Bolt on ' A1'C
	Standalone ' B1'C
LUD OU#:	
1st Printer	'0018'X
2nd Printer	'0058'X
Power Control	'0100'X for all models
Session Definition Data:	binary zero
Load/Dump Indicator:	binary zero
Specific Characteristics	
Length:	'0000'X
Retry Value Length:	'0000'X
Error Threshold Length:	'0000'X
Device Specific Contents	
Length:	485
Device Specific Modifiable	
Length:	485

Device Specific Area (DSA)

Char(485)

Byte 0	Control Flags	Char(1)
Bits 0-1	Reserved	Bit(2)
Bit 2	Write Control	Bit(1)
	0 - No data translation	
	1 - Translate the data	
Bits 3-7	Reserved	Bit(5)
Byte 1	Lines Per Inch	Char(1)
Byte 2	Lines Per Form	Char(1)
Bytes 3-4	Character Set Length	Bin(16)
Bytes 5-292	Character Set	Char(288)
Bytes 293-484	Translate Table	Char(192)

The device specific parameters may or may not be supplied in the DSA area of a create template. If they are not supplied at create time, the create template must still contain the 485-byte area and this area should be set to zero. The LUD will be created to contain whatever is in the template, without validating any of these parameters. These parameters are not reflected at the device until a MODLUD Modify DSA command is received. These parameters are not used until after the LUD is in active session state and processing a REQIO message. See the next section for details on how the device specific parameters are used.

The character set length is the number of unique characters on the print belt. For valid values, consult System/38 Hardware Specifications, Volume IV-B, Section 5.

The character set is the unique characters on the print belt. This specified portion will be repeated until the entire buffer is filled.

The translate table specifies how each character of print data should be printed. By properly specifying the translate table, characters that would have been treated as unprintable may be printed as some other character that is on the belt (eg, lowercase letters may be translated to uppercase for belts lacking lowercase).

4.3.3 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

The following is a list of functions the 3262 and 5211 support through the MODLUD instruction:

POWER ON
POWER OFF
VARY ON
VARY OFF
ACTIVATE
DEACTIVATE
MODIFY DEVICE SPECIFIC AREA
QUIESCE
RESET
RESUME (Activate after suspend, quiesce, or reset)
SUSPEND

Refer to the Modify LUD Instruction for the meaning of each function.

4.3.3.1 LUD Device Specific Area

The device specific area contains the information used by the printer attachment to control the line spacing, form size, belt image, and translate table used by the printer. This area may be altered via MODLUD at any time. Changing any portion of the DSA causes all DSA parameters to be written to the printer. It should be noted that any changes to the device specific area are reflected in the machine's processing of the next REQIO received.

The control flags field controls the translate mode in the machine. If translate data is specified, the data is translated based on the translate table prior to printing.

For the 3262 and 5211, the lines per inch must be either 6 or 8. The lines per form setting must be greater than or equal to 2 and less than or equal to 84 for 6LPI, and greater than or equal to 2 and less than or equal to 112 for 8 LPI.

4.3.3.2 MODIFY LUD - Device Specific Area

A MODLUD (DSA) command must be issued any time after the LUD is in varied on state and before any printing operations are started. If this is not done, a command reject feedback record will be generated on the first request I/O to perform print operations. This causes the printer to be initialized to the desired parameters for line spacing, form size, belt image, and translate table. This set of DSA parameters is then used until the next MODLUD (DSA) occurs or until the LUD is varied off. The printer is not initialized in any other way such as at MODLUD (Activate Session) time.

If the DSA parameters supplied for a MODLUD (DSA) command are invalid, a template value invalid exception may be signaled if the IOM has diagnosed the error or a terminating error feedback record ('E010000B'X) will be signaled for the next request I/O instruction if the device detects the error.

4.3.4 REQUEST I/O INSTRUCTION (REQIO)

The request I/O instruction is used to send I/O requests to the device.

The SSR for a REQIO to the 3262 or 5211 contains the following values:

S/S Object Response Queue	System Pointer to LUD System Pointer to Response Queue
S/S Data Area (SSD)	Space Pointer
Optional Pointer	Reserved (binary zero)
Request Priority	See Vol III REQIO
Request ID	See Vol III REQIO
Function Field	'80'X
Control Field	'N' or 'C'

Key Length	See Vol III REQIO
Key OFFSET	Bin(2)
RD COUNT	1 (or 0 for REQIO Continue)
RD OFFSET	Bin(2)

The 3262 and 5211 support only one RD per REQIO. The RD offset field indicates the offset from the start of the SSR to the 16 byte RD. The S/S Data Area (SSD) contains the data to be printed.

The format of the RD is as follows:

Byte 0	Command	Char(1)
	'41'X - Print SCS Data	
	'42'X - Continue printing after error	
Bytes 1-3	Command Modifiers	Char(3)
Bytes 4-15	Reserved (binary zero)	Char(12)

SCS Print ('41'X)

The SCS print command causes a block of data to be printed. This block could be entirely SCS NO-OPs in which case the printer would not do anything.

Continue Printing After Error ('42'X)

A command of '42'X is used for error recovery. When received, printing will continue as if the previous error had not occurred. This command is intended for use only after errors which allow an ignore response as listed in Final Pacific Hardware Functional Specification, Volume IV-B, section 5. If given after the other errors listed it will be accepted, but results are unpredictable. An invalid RD command error will be signaled on the following conditions:

1. The preceding REQIO did not have one of the errors listed in Vol IV-B

A REQIO Continue is still needed to resume processing. The command modifier field (bytes 1, 2, & 3 of the RD) for the SCS print command has the following format:

Byte 1		Char(1)
Bits 0-4	Reserved (binary zero)	
Bit 5	Unused	
Bit 6	Unprintable Character Detection	
	0 = Signal unprintable character detected error	
	1 = Do not signal to user	
Bit 7	Save Data	
	0 - Start printing at beginning of SSD	
	1 - Retain any data saved from previous SCS print and continue where left off	
Bytes 2-3	Data Block Group Count	Bin(2)

The Unprintable Character Detection bit indicates whether or not this condition should be signaled to the user. It is significant for each particular SSR.

The Save Data bit should normally be on; the adapter will determine if part or all of the previous data was used and continue printing where it left off.

The Data Block Group Count field indicates the number of 8 byte blocks in the SSD. The last 8 byte block must be padded out to a full 8 bytes with blanks or NO-OPs. The maximum number of 8 byte blocks is 8192.

The Continue Printing After Error ('42'X) will be treated as follows:

- The SSD printer value is ignored.
- The Unprintable Character Detection bit is significant with the same function.
- The Save Data bit is ignored. Processing assumes it to be on ('1'B).
- The Data Block Group Count is ignored.

SCS INSTREAM COMMANDS

The SSD must be doubleword aligned and is made up of a mixture of SCS commands and data to be printed. The System/38 printers use the instream command codes defined in document SNA-0091-04. These SCS command definitions are the ones also used by the 5256 (PERMA) Matrix Printer.

All 5256 SCS instream commands used in printing that have a corresponding function on the 5211/3262 are supported, while 5256 SCS commands that have no corresponding function are NO-OP'ed. There are no SCS commands used only on the 5211/3262.

No initializing is done with SCS commands on the 5211/3262. If any initializing SCS commands are received (load image, set forms length, set translate table, etc), they are NO-OP'ed.

When printing on an SCS command, the data stream written to the printer contains two types of codes:

1. Print Characters--X'40' through X'FE'. This is data to be printed. It may require translation and may result in an unprintable character. If a character is unprintable, it may or may not be posted as an I/O exception, depending on the translate data loaded or the control bit in the RD.
2. SCS Commands--X'00' through X'3F' and X'FF'. These instream control characters determine the format of the printed output. Any codes less than X'40' that are not recognized, or a code of X'FF', will result in an 'INVALID SCS' error being posted.

For a detailed discussion of each command, refer to System/38 Hardware Functional Specification.

Any form boundary crossing should use a 'form feed' command. If this is not done, an error may not be posed. However, on error recovery, printing and forms may not be properly aligned. The last request

of a print file should have a 'form feed' in the last byte of the SS data block to assure that all printer operations will complete before posting ending status. If this is not done, it is possible that an error could be posted to the wrong print file.

4.3.4.1 Feedback Record

The format of the feedback record is as follows:

Bytes 0-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for descriptions of the Request Address and Request ID fields.

The Error Summary field defines the status of the REQIO as generically defined in the REQIO instruction description. The specific values possible for the 3262 & 5211 are itemized in Table 1 which follows.

The RD Number is the index of the last RD processed or the RD in error if an error is indicated. For the 3262 and the 5211, the RD number will be one.

The RIU Segment Count is the number of forms completed by the printer while servicing this request until an error occurred. If no error occurred, this field is undefined.

The Device Dependent area is all binary zero unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction.) If the device dependent data is present, the fields have the following definitions.

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered.

The time stamp and OU# are the same values present in the hardware error log entry and are used to correlate the FBR and the error log entry for maintenance purposes.

Table 1: 3262 and 5211 Error Summary Values

Error Summary	Dev Dep Err Code	Hardware Err Code	Meaning	Recovery
X'0000'	N/A	N/A	Normal Completion	N/A
X'0008'	N/A	N/A	Request I/O continue response	N/A
X'C009'	N/A	N/A	Partially processed request terminated due to reset session	Activate must be issued to restart processing or a deactivate must be issued to terminate the session
X'C00A'	N/A	N/A	Unprocessed request due to reset session	Activate must be issued to restart processing or a deactivate must be issued to terminate the session
X'C00B'	N/A	N/A	IOM Partial Damage	The LUD must be varied off to clear this condition. A partial damage event has also been signaled.
X'C010'	N/A	N/A	REQIO rejected due to device being disabled. (OU task failure)	The MODLUD reset, deactivate, vary off, vary on, and activate functions must be issued to restart processing. The LUD failure event has also been signaled.
X'E041'	1001	N/A	SSD destroyed	Provide a correct SSD, perform any higher level error recovery which is necessary for data which may have been lost, then reissue REQIO, and issue REQIO continue
	1002	N/A	SSD truncated or suspended	
	1003	N/A	SSD damaged	
X'C043'	N/A	N/A	Invalid SSD boundary alignment	Correct boundary alignment, re-issue REQIO, issue REQIO continue.
X'C044'	N/A	N/A	SSD too small	Correct SSD, perform any higher level error recovery which is necessary for data which may have been lost, then reissue REQIO, issue REQIO continue.
X'C084'	N/A	N/A	Invalid pointer to SSD	Replace SSD pointer with a valid pointer, reissue REQIO, issue REQIO continue.
X'C085'	N/A	N/A	Invalid Function Field	Correct the function field value, reissue REQIO, issue REQIO continue.
X'C086'	N/A	N/A	Invalid RD Count	Remove extra RDs, re-issue REQIO, issue REQIO continue.
X'E010'	X'0002'	X'4450'	Invalid SCS command.	Command is invalid. Check SCS codes, correct command in error, and reprint the form. A REQIO continue must be issued to restart processing.
X'E010'	X'0003'	X'5437'	Forms jam	Correct the forms jam and reprint form or forms. A REQIO continue must be issued to resume processing.
X'E010'	X'0004'	N/A	CE switch in wrong position	Check for CE switch setting, reissue REQIO, and issue REQIO continue.
X'E010'	X'0005'	X'3203'	Unrecoverable I/O error (OU task failure)	MODLUD reset, deactivate, vary off required to clear this condition.

Table 1: 3262 and 5211 Error Summary Values

Error Summary	Dev Dep Err Code	Hardware Err Code	Meaning	Recovery
X'E010'	X'0006'	N/A	Unprintable character detected	Line has been printed with blank substitution. If blank substitution acceptable, reissue failing REQIO with 'continue printing after error' command and issue REQIO continue. If not, correct print data, translate table, or train image. Issue REQIO continue and reprint the file.
X'E010'	X'0009'	N/A	Interlock open	Correct situation, ready printer, issue REQIO continue and reissue failing REQIO message.
X'E010'	X'000B'	X'3215'	Actual belt image length does not equal specified belt length or a X'00' was detected in image data	Put correct belt on printer or change X'00' in image data Reissue failing REQIO. A REQIO continue needed to restart processing.
X'E010'	X'000C'		Printer or hardware adapter failure.	Operator intervention required.
		X'4008'	- Carriage Advance Overrun	Reprint the form. A REQIO continue needed to restart processing. If error persists call the CE.
		X'4080'	- IOC-DBI Parity Error	
		X'4040'	- IOC Parity Error	
		X'4020'	- CSA Parity Error	
		X'5425'	- Any hammer on check	
		X'5427'	- Data Parity Check	
		X'5432'	- Pedestal Check	
		X'4447'	- Invalid interrupt	
		X'5441'	- Printer busy too often	
		X'5440'	- Printer busy too long	
		X'5430'	- Belt sync check	
		X'5443'	- Fire tier sync check	
		X'5426'	- Hammer echo check	
X'E010'	X'000D'		System error	System failure. Reprint form. A REQIO continue must be issued to resume processing. If error persists, seek software assistance.
		X'3203'	- Channel Error	
		X'3205'	- Command reject	
		X'4034'	- Invalid Disconnect	
		X'4038'	- Invalid OU#	
		X'4452'	- Invalid Channel sequence	

Table 1: 3262 and 5211 Error Summary Values

Error Summary	Dev Dep Err Code	Hardware Err Code	Meaning	Recovery
		X'9000'	- OP Program Error	
X'E010'	X'000E'	X'5434' X'5435' X'5451'	Permanent hardware error - Thermal Check 1 - Thermal Check 2 - Contactor Stuck	Seek hardware assistance. The LUD failure event is signaled.
X'E010'	X'000F'	X'5431' X'5433'	Belt speed check Belt up to speed check	Inspect belt, and align forms. A REQIO continue needed to restart processing.
X'E010'	X'0010'	X'5420' X'5423' X'5424' X'5442'	Forms alignment -Carriage Check 1 -Carriage Check 2 -Carriage Check 3 -Carriage Check 4	Align forms and reprint the form. A REQIO continue needed to restart processing.
X'E010'	X'0011'	X'5436'	Ribbon Check	Inspect the ribbon. Reprint the form. A REQIO continue needed to restart processing.
X'E010'	X'0012'	X'5421'	Manual carriage check	Inspect belt & align forms. Reprint the form. A REQIO continue needed to restart processing.
X'E010'	X'0014'	X'5444'	Power fault	The modlud reset, deactivate, vary off, power off, power on, vary on, and activate messages must be issued to restart processing.
X'E010'	X'0015'	X'5422'	Cable interlock	The modlud reset, deactivate, vary off, vary on, and activate messages must be issued to restart processing.
X'E010'	X'0016'	N/A	End of forms	Add paper, make printer ready, reissue REQIO, and issue REQIO continue.
X'E087'	X'0007'	N/A	Invalid RD command detected or command '42'X received when not valid	Correct RD command byte, reissue REQIO, and issue a REQIO continue.
X'E087'	X'0008'	N/A	Zero data block field in the RD or > 8192 data blocks specified	Correct the data block field, reissue the REQIO, and issue a REQIO continue.
X'E087'	X'0017'	N/A	Reserved fields violated	Zero reserved fields, reissue REQIO and issue a REQIO continue.
X'F075'	N/A	X'4101' X'4102' X'4103' X'4105' X'4106'	Errors during error recovery - FOB timeout - Invalid adapter response - Startup command failure - ERP failure-- (except timeout or channel error) on RD sense - ERP failure	Seek hardware assistance. A LUD failure event is also signaled.

Table 1: 3262 and 5211 Error Summary Values

Error Summary	Dev Dep Err Code	Hardware Err Code	Meaning	Recovery
		X'4107'	(timeout or channel error) on RD sense - ERP failure (except timeout or channel error) on RD ERRLOG	
		X'4108'	- ERP failure (timeout or channel error) on RD ERRLOG	

4.3.5 EVENTS AND EXCEPTION CODES

4.3.5.1 Events

The following events are signaled by the 5211/3262 in addition to the events identified generically in the REQIO instruction. For a complete description of the following events, see Chapter 8 of this document.

- LUD Contact Event (000B 06 01)

This event is signaled by the MSCP when VARY ON processing is completed for this device. Only subtype 01 (contact successful) is signaled. Subtype 02 (unsuccessful contact) is never signaled since the MSCP processing is synchronous to the Modify LUD (vary on) and an exception will be signaled instead.

- LUD Failure Event (000B 08 01)

This event is signaled and an error log entry is made whenever the printer has an uncorrectable problem; that is, where the recovery action is to call the CE. As part of the recovery action for this event, the LUD should be varied off before attempting further operations.

The 14-byte variable data returned with this event is formatted as follows:

Bytes 0-1 Status--Hardware Error Code which was included in the error log message. See Table 1 of Section 4.3.4.1 for a list of these error codes and the appropriate recovery actions. This event will only be signaled for those failures which have hardware error codes corresponding to feedback error summary cases F075 and E010 000E in Table 1 (approximately 9 codes).

Bytes 2-9 Time stamp--contains the time stamp of the corresponding error log message.

Bytes 10-11 OU Number--'0018'X or '0058'X.

Bytes 12-13 Optional Data--Binary Zero.

- Operator Intervention Required Event (000B 07 01)

This event is signaled when the device goes to a state that requires the operator to take some action yet is not an error.

The 14 byte variable data returned with this event is formatted as follows:

Bytes 0-1 Status--Code which was included in the error log message if there was a corresponding error log message, otherwise zero.

Bytes 2-9 Time stamp--contains the time stamp of the corresponding error log message, otherwise zero.

Bytes 10-11 OU Number--'0018'X or '0058'X.

Bytes 12-13 Optional Data--See following table.

Condition	Indication	Description	Recovery Procedure
Byte 12 bit (0)	READY OFF	SCS command was received and the printer was not ready. Printer is stopped and not ready as a result of a normal stop condition and no errors exist.	Press Start

The remaining bits of bytes 12 and 13 are zero.

- REQIO Complete Event (000B 09 01)

This event is signaled when the request has been processed, if this event signaling has been requested by the user. See REQIO for details.

- REQIO Response Queue Destroyed Event (000B 0A 01)

This event is signaled if the user truncates or destroys the Request I/O Response Queue while the machine is processing REQIOs.

4.3.5.2 Exception Codes

The following table provides a summary of the cases where the S/S Resource Not Available exception ('3404'X) will be signaled when a MODIFY LUD instruction is executed for the printer LUD.

<u>COMMAND</u>	<u>EXCEPTION DATA</u>		
	<u>GENERIC</u>	<u>SPECIFIC-CODE</u>	
Power On	'2306'X	'0601'X	I/O device power failure. LUD failure event has also been signaled.
Power Off	'2307'X	'0601'X	Same as above.
Vary On	'2302'X	'0001'X	I/O device failure has occurred. LUD failure event has been signaled.
Activate Session	'2303'X	None	Exception is not signaled.
Resume Session	'2311'X	None	Exception is not signaled.
Suspend Session	'2312'X	'1203'X	Suspend rejected due to operator intervention condition existing.
Quiesce Session	'2313'X	'1302'X	Quiesce failure due to a terminating error condition.
	'2313'X	'1303'X	Quiesce rejected due to operator intervention condition existing.
Device Specific Area	'2300'X	None	Exception is not signaled.

Bytes 5-75	Unused	Char(71)
Byte 76	Type	Char(1)
	'40'X - 1 sided, FM mode	
	'2'C - 2 sided, FM mode	
	'M'C - MFM mode, 2 sided	
Bytes 77-79	Unused	Char(3)
Byte 80	Sector Size	Char(1)
	'40'X - 128 byte sectors	
	'1'C - 256 byte sectors	
	'2'C - 512 byte sectors	
	'3'C - 1024 byte sectors	
Bytes 81-132	Unused	Char(52)
Bytes 133-260	File Header	Char(128)
Bytes 133-166	Unused	Char(34)
Bytes 167-171	End of Extent (CCHRR)	Char(5)
Bytes 172-176	Unused	Char(5)
Byte 177	Multi-vol indicator	Char(1)
	'40'X - data set complete on volume	
	'C'C - continued on another volume	
	'L'C - last volume of the data set	
Bytes 178-179	Vol Sequence number	Char(2)
	'4040'X - noncontinued	
	'01'-'99'C - continued	
Bytes 180-206	Unused	Char(27)
Bytes 107-211	End of data (CCHRR)	Char(5)
Bytes 212-260	Unused	Char(49)
Bytes 261-266	Status Flags	Char(6)
Byte 261	Reserved (binary zero)	Char(1)
Byte 262	Current slot number (binary zero)	Char(1)
Bytes 263-265	Bad cylinders (binary zero)	Char(3)
Byte 266	Reserved (binary zero)	Char(1)
Bytes 267-527	Reserved	Char(261)

The current volume label and file header fields are ignored on CRTLUD and would generally contain binary zeros or blanks. The fields other than 'unused' could be specified, if known, but are usually set after a REQIO for READ VTOC has been executed. The normal startup procedure would be:

```

MODLUD - Vary On
MODLUD - Activate Session
REQIO - Increment Diskette Address (loads diskette)
MODLUD - Set encoding bit (if needed)
REQIO - Read VTOC
MODLUD - Modify DSA (set current volume label and
file header fields from Read VTOC data)
REQIO - Seek to Address
REQIO - Read/Write
.
.

```

The current volume label and file header fields are formatted just as on the diskette so that they can be set directly from the Read VTOC information. The values in the 'unused' fields are ignored. The end of extent and end of data fields have a 5-character CCHRR format where:

```

CC=Cylinder  '01' - '74'C for end of extent
              '01' - '75'C for end of data
H=Head       '0' or '1'C
RR=Sector    '01'C - (dependent on sector size,
                  see the Seek to Address
                  command)

```

If a MODLUD Activate Session is issued, the type, sector size, and the end of extent/end of data sector number in the LUD device specific contents area are checked for valid values. If invalid values are specified, the following defaults are used internally for I/O processing:

```

Type          - 1 sided, FM mode
Sector Size   - 128-byte sectors
EOE/EOD Sector Number - If 0, default to 1

```

These defaults would be used until a MODLUD of the device specific area was issued. If any of these values were found invalid at that time, the MODLUD would be rejected and MI exception 'Template Value Invalid' is signaled.

The current slot number and bad cylinders fields are feedback areas for MATLUD and should be binary zero for CRTLUD. The current slot number field is set whenever the Increment Diskette Address command in REQIO is used and can have values of 1-23 ('01'-'17'X). The bad cylinders field is set only when a diskette is formatted by REQIO and is initialized to 'FFFFFF'X. For bad cylinders, each byte (for up to 3 bad cylinders) can have values of 0-76 ('00'-'4C'X).

4.4.3 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

The following is a list of functions 72MD supports through the MODLUD instruction.

```

VARY ON
VARY OFF
ACTIVATE
DEACTIVATE
SUSPEND
QUIESCE
RESET
RESUME (Activate after suspend, quiesce or reset)
RETRY VALUES
ERROR THRESHOLD VALUES
LOAD/DUMP INDICATOR
MODIFY DEVICE SPECIFIC CONTENTS

```

Refer to the Modify LUD for the meaning and use of each function.

The following are special considerations taken by the machine for the MODLUD function listed:

VARY ON and DEACTIVATE will eject a diskette, if one is loaded, and then cause the magazine to go to the home position (for the definition of home position, see the REQIO-Increment Diskette Address command, Section 4.4.4.1 of this document).

RESET will cause the machine to cease processing at its earliest opportunity. Continuing the session after this yields unpredictable results.

The first 261 ('105'X) bytes of device specific contents area of the LUD (the active session flags, current volume label and file header fields) may be altered at any time through the use of the MODLUD instruction. It should be noted that any changes to the device specific area are reflected in the I/O commands issued to the device. The area is generally altered only prior to beginning the processing of a file, to set the Volume Label and file header, and not during the processing of a file. If the user does alter the area during file processing, the results are unpredictable and could cause I/O errors. The status flags field are feedback areas meaningful only to MATLUD and are not modifiable. The other modifiable fields in the LUD template are described under the MODLUD instruction.

Modify Load/Dump Indicator

To operate the 72MD device for normal (date interchange) operation, the Load/Dump Indicate field in the LUD should be set as follows:

```
Load/Dump Device:      '01'X (set at create time)
Operating Mode:        '00'X Normal Mode
Load/Dump Pending:     binary zero
Corresponding Primary
Address:                binary zero
Load/Dump Exchange
```

To operate in Load Mode or Dump Mode, the Operating Mode field can be set as follows:

```
Operating Mode:  '01'X Load Mode-
                  primary device
                  '02'X Dump Mode-
                  primary device
```

All other fields should be set as in normal mode. These functions are not used by the 72MD device.

Status: binary zero

Load/Dump Performance

Attributes

- L/D Buffer Storage	Bin(2)	This field is used to specify the amount of buffer storage which L/D is allowed to extract from the user's process storage pool. This value is specified in units of minimum machine transfer size (512 bytes). Values
----------------------	--------	--

for 72MD can range from 32 to 128 (for buffer sizes from 16K to 64K bytes).

```
- L/D Process      Char(1) This field can be used to
  Priority          specify the relative
                   priority at which the
                   internal L/D processes
                   will run at. A value of
                   zero specifies the
                   highest priority. This
                   parameter allows the L/D
                   to contend with other
                   concurrent user processes
                   in a manner where L/D has
                   very little impact on
                   other processes or con-
                   versely where L/D perfor-
                   mance itself experiences
                   very little impact.
```

4.4.4 REQUEST I/O INSTRUCTION (REQIO)

The SSR for a REQIO to 72MD contains the following values:

S/S Object	-	Pointer to the LUD
Response Queue	-	Pointer to response queue
S/S Data Area	-	Space Pointer
Optional Pointer	-	Reserved (binary zero)
Request Priority	-	See Volume III, S/S REQIO
Request ID	-	See Volume III, S/S REQIO
Function Field	-	'80'X
Control Field	-	'N' or 'C'
Key Length	-	Bin(2)
Key Offset	-	Bin(2)
RD Count	-	Bin(2)
RD Offset	-	Bin(2)

The machine does not check the label information except on a VTOC operation. On a write VTOC operation, the first record in the SSD (volume label) must begin with 'VOL1', and any header labels to be written must begin with 'HDR1'. On a read VTOC operation, the first record read from the diskette must begin with 'VOL1' and the only subsequent records placed in the SSD are those that begin with 'HDR1'.

If the diskette encoding bit in the device specific area of the LUD specifies ASCII and it is a read operation, the machine translates the ASCII data that is read into EBCDIC. If ASCII is specified and it is a write operation, the machine takes the EBCDIC data from the SSD and translates it to ASCII before the write operation takes place. If EBCDIC is specified, no translation takes place.

NOTE: If an error recovery action is to reissue the REQIO in error, the RDs and SSR should not be altered or unpredictable results could occur. An exception to this rule is documented in the Write R0 section.

4.4.4.1 Request Descriptor (RD)

A REQIO (other than continue) to the 72MD IOM must contain one or more RDs. Only 1 write or read RD is allowed per REQIO, ie, a REQIO with one read and one write RD will result in an error. Any number of seek, address, format, halt, or increment commands may exist in a REQIO, with or without a single read or write RD.

The format of the RD is:

Byte 0	Command	Char(1)
	'01'X - Write	
	'02'X - Read	
	'04'X - Seek to Address	
	'05'X - Format Diskette	
	'0C'X - Increment Diskette	
	Address	
	'18'X - Address	
	'1C'X - Halt	
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
	0 - Perform Command	
	1 - Ignore Command	
Bits 1-7	Command Specific (see commands)	
Bytes 2-6	Command Specific (see commands)	Char(5)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Segment Count	Bin(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by the REQIO execution.

The command field indicates the type of operation to be performed. The specific commands are described later.

The control field indicates whether the RD is to be ignored or not and generally is a binary zero when the instruction is issued. This field is set by the machine to a binary one when the RD is successfully completed. This fact is useful when restarting an operation after an error. The REQIO can be reissued and all RDs that were completed will be ignored and the RD that failed will be retried. After normal completion, this field must be reset before the SSR can be reused.

The segment count field identifies the number of consecutive sectors to be transferred by the operation. This field is not used for a Read VTOC, Read VTOC IPL, or Write VTOC IPL.

Each segment corresponds to the sector size on the diskette and is accessed sequentially. All RD commands use the parameters expressed in the device specific area of the LUD. All command modifier bytes must be reinitialized unless the RD command reissued is a previous partially complete REQIO (ie, end of volume, error recovery actions, etc).

SSD Conventions

Sectors are placed into the SSD consecutively with no control bytes between sectors. A reissued REQIO begins at the position indicated by the segment count, sectors transferred count, sectors skipped count, and the sector size in the LUD. The data area (SSD) for any read or write command must be page aligned.

RD Commands

The following are the commands supported in the REQIO instruction:

WRITE ('01'X)

The format of the RD for a Write command is as follows:

Byte 0	Command ('01'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bit 1-2	Write Control	
	'00'B-Normal Write	
	'10'B-Write VTOC	
	'01'B-Write VTOC IPL	
Bits 3-7	Reserved (binary zero)	
Byte 2	Unused	Char(1)
Bytes 3-6	For normal Request I/O cases:	
Bytes 3-4	Sectors Transferred	Bin(2)
	Count*	
Bytes 5-6	Unused	Char(2)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Segment Count	Bin(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields returned by the REQIO instruction execution.

Normal Write

An RD specifying normal write is used to write one or more sectors to any cylinder other than cylinder zero. The device must have been previously positioned to the first sector to be written.

The number of sectors to be written must be greater than zero or an error will be signaled. The number of sectors to be written is the segment count minus the sectors transferred count. Normally, when an RD is first issued, the sectors transferred count field will be zero. The sectors transferred count in the RD is incremented for every sector written. The 72MD device does not write any deleted or relocated sectors, but does write over deleted or relocated sectors. When the RD is marked as successfully completed, the sectors transferred count will equal the segment count.

If a sector media write error FBR is returned, the device is positioned after the sector that could not be written.

If, while writing, an end of track is encountered, the machine automatically moves to the next sequential sector: to the other side of a two-sided diskette, or to the next good cylinder (alternate

cylinder allocation schemes are not supported). End of volume is indicated when the sector written corresponds to the end of extent field in the file header record located in the device specific area of the LUD. If the end of extent value is wrong (greater than the diskette capacity), an I/O error will occur. In an end-of-volume condition, the user must handle the situation and reissue the REQIO being processed when the error occurred.

Write VTOC

An RD specifying Write VTOC is used to write all of cylinder zero (starting with sector 7) with a VOL label, header labels, and deleted sectors.

If the first 128 byte record in the SSD does not begin with 'VOL1' an error is returned. Each of the subsequent 128 byte records in the SSD starting with 'HDR1' are also written. Ones not starting with 'HDR1' are ignored in the SSD. The segment count indicates the number of 128 byte records in the SSD and must be greater than zero. The maximum number of records possible on the front side of a diskette (including the VOL) is 20. On the back side, the maximum number of records possible in FM mode is 26 or, in MFM mode, is 52.

When the SSD is exhausted, the rest of cylinder 0 (both sides if two-sided) is written with deleted records (records starting with 'DDR1'). If the diskette encoding bit in the LUD specifies ASCII, the VOL, header and deleted records will be written in ASCII format. When a Write VTOC is executed, the machine will do an implicit seek to the VTOC area. Following the Write VTOC, a seek must be done to position for a normal read/write since the former position is not retained. It is not possible to write more than cylinder zero with this command. The number of headers written (including the VOL, excluding deleted) will be returned in the sectors transferred count field (which initially must be binary zero). Normal completion of the Write VTOC command results in an error FBR and requires a REQIO-Continue to continue.

Write VTOC IPL

The write VTOC IPL RD command is used to write the first 3 sectors of cylinder 0 with 384 bytes of data from the SSD. At the normal completion of a VTOC write, an error FBR is returned and the user need only issue a REQIO-Continue whenever processing is to resume.

When a VTOC IPL write is executed, the machine will do an implicit seek to the VTOC area and the former position is not retained. It is not possible to write more or less than 384 bytes with this command. The sectors transferred count and segment count fields are unused. An error in writing a sector causes the operation to stop and a device error to be returned in the FBR.

Data Conversion

If the data is to be converted from EBCDIC to ASCII format, the data is copied from the SSD area to an internal buffer, then converted in the internal buffer.

Conversion is done only on a cylinder boundary. If the data to be written requires more sectors than are available on the cylinder to be written on, any data converted, on a cylinder basis, would have been written and the position of the read/write heads would have incremented to the next cylinder(s).

Conversion will not occur on a Write VTOC IPL RD command since the data is always written in EBCDIC format.

READ-('02'X)

The format of the RD for a Read command is as follows:

Byte 0	Command ('02'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bits 1-2	Read Control	
	'00'B - Normal Read	
	'10'B - Read VTOC	
	'01'B - Read VTOC IPL	
Bits 3-7	Reserved (binary zero)	
Byte 2	Unused	Char(1)
Bytes 3-4	Sectors Transferred Count*	Bin(2)
Bytes 5-6	Sectors Skipped Count*	Bin(2)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Segment Count	Bin(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by the REQIO instruction execution.

Normal Read

An RD with the read control field set to normal read is used to read one or more sectors from any cylinder. (To read cylinder zero sectors with the normal read, see "Normal Read of Cylinder Zero" later in this section.) The device must have been previously positioned to the first sector to be read. The first sector read will be placed in the SSD at the offset indicated by the sectors transferred count multiplied by the sector size in the LUD.

The number of sectors to be read must be greater than zero or an error will be signaled. The number of sectors to be read is the segment count minus the sectors transferred count and the sectors skipped count. Normally, when an RD is first issued, the sectors transferred count and sectors skipped count fields will be zero. The sectors transferred count in the RD is incremented for every sector transferred to the SSD. The sectors skipped count in the RD is incremented every time an error is signaled due to the occurrence of a sector marked as deleted or sequentially relocated. When the RD is marked as successfully completed, the sum of the sectors transferred count and the sectors skipped count will equal the segment count and the SSD will contain the number of sectors indicated by the sectors transferred count. When a sector marked as deleted or sequentially relocated is encountered the sectors skipped count is increased, an error FBR is

returned, nothing from that sector is placed in the SSD, and the device is positioned after the sector in question. The user only has to issue a REQIO-Continue to clear the error and reissue the same Read REQIO (unmodified) to continue reading subsequent sectors. A bad sector error works exactly the same way except that the sectors skipped count is not incremented. This allows the user to either quit reading there or to note the sector that was missed and to continue reading the rest of the file.

Each sector on the diskette has a sequential sequence number preceding it. The sequence numbers are checked by the machine when reading a diskette. Some non-system/38 written diskettes may not have sequential sector sequence numbers. When a sector sequence number error is encountered, the device is left positioned at the sector in error and an error FBR is returned. The user has only to issue a REQIO-Continue and reissue the same Read REQIO (unmodified) to read the sector (since it is now the starting sector of a new read). If the following sector's sequence number is not one larger than the previously read one, another sector sequence error will be signaled.

If, while reading, an end of track is encountered, the machine automatically moves to the next sequential sector: to the other side of a two-sided diskette, or to the next good cylinder (alternate cylinder allocation schemes are not supported).

End of volume and end of data conditions are checked at all times, by using the volume and file header information stored in the LUD. On end of volume, the user (after issuing a REQIO-Continue) causes a new diskette to be loaded, reads the VTOC, modifies the LUD with the volume and file data, seeks to the correct address, and then can reissue the REQIO to continue reading.

NORMAL READ OF CYLINDER ZERO

Special requirements and limitations are necessary to read sectors from cylinder zero using normal read because of its uniqueness to the other cylinders on the diskette. A seek REQIO must be issued to position the read/write head at cylinder zero (see SEEK TO ADDRESS command).

The segment count field in the Read RD must be set to 1, meaning only one sector at a time may be read.

The following fields in the DSA of the LUD must be set to reflect the characteristics of the particular sector to be read from cylinder zero rather than the characteristics of the data sectors on cylinders 1-74.

- | | |
|---------------------|-------------------|
| - Diskette Encoding | - EBCDIC/ASCII |
| - Type | - 1-FM, 2-FM, MFM |
| - Sector Size | - 128, 256 |

End of Extent and End of Data must be set beyond the sector to be read.

Sectors 1-3 of cylinder zero are always in EBCDIC. The remaining sectors may be either EBCDIC or ASCII.

Sectors on the front side of cylinder zero are always 128 bytes--FM. If the diskette is two-sided, the sectors on the back of cylinder zero may be 128 bytes--FM or 256 bytes--MFM.

Normal Read Error Correction

When the retry limit for a Data CRC ERROR on a normal read has been reached and the last three reads produced the same incorrect data, and it has been determined that the error is a single bit error, an attempt will be made to correct the bit in error.

An error log entry will be made to indicate whether the error was corrected or not.

Read VTOC

A Read RD specifying Read VTOC is used to read cylinder zero for the volume label (indicated by VOL1 in the first 4 characters) and all undeleted, valid header records (those which have HDR1 as the first 4 characters). Only the volume label and the valid, undeleted header records are placed in the SSD. The SSD must be large enough to hold the maximum number of records (20 for a one-sided diskette, or 46 or 72 for a two-sided diskette). (VTOC records are always 128 bytes long.) The sectors transferred count is set to indicate the number of records placed in the SSD (including the VOL). The maximum number of records possible on the front side of a diskette (including the VOL) is 20. On the back side, the maximum number of headers possible in FM mode is 26 or, in MFM mode, is 52.

The segment count and sectors skipped count are not used with a Read VTOC.

When a Read VTOC is executed, the machine does an implicit seek to the correct position on the disk. Following the Read VTOC, a seek must be done to position for a normal read or write, since the former position is not retained.

Normal completion of a Read VTOC results in an error feedback record (FBR) and requires a REQIO-Continue to continue. This was done to facilitate EOV processing, for example. The end of volume (EOV) sequence of events could be as follows:

- EOV error on a REQIO.
- Issue REQIO to load the new diskette (with lower key value to bypass REQIOs already on the queue).
- Issues REQIO Read VTOC (lower key value).
- Issue REQIO-Continue to release the above REQIOs.
- Read VTOC complete error--analyze header info.
- Issue MODLUD to Modify VOL and HDR fields.
- Issue a REQIO to seek to first sector of the new file (lower key value).
- Reissue REQIO--read (lower key value).

- Issue REQIO-Continue to release above REQIOs

Encountering a bad sector causes the read to stop. Sectors previously read are in the SSD. Subsequent sectors are accessible by using the 'Normal Read of Cylinder Zero' command.

Read VTOC IPL

The read VTOC IPL function is used by system programming functions at IPL time and reads the first 3 sectors from cylinder zero (384 bytes).

At normal completion of this read, an error is signaled to allow the user to analyze the data. To recover from this condition, the user need only issue a REQIO continue whenever processing is to resume. When this read is to be executed, the machine does an implicit seek to the correct position on the disk and the former position is lost.

Encountering a bad sector causes the operation to stop and subsequent sectors are accessible by using the 'Normal Read of Cylinder Zero' command. The sectors transferred count, sectors skipped count, and segment count fields are not used with Read VTOC IPL.

Data Conversion

If the data read is to be converted from ASCII to EBCDIC or a Read VTOC operation, the first four bytes read from sector 7 are not 'VOLL' in ASCII format, nothing is transferred to the SSD area. This is also true if EBCDIC mode is specified and the first four bytes are not 'VOLL' in EBCDIC format.

Conversion will not occur on a Read VTOC IPL RD command since the data is always written and read in EBCDIC format.

SEEK TO ADDRESS ('04'X)

An RD specifying seek to address causes the device to position to a specific cylinder-head-sector address on the currently loaded diskette.

The format of the RD for the seek to address command is as follows:

Byte 0	Command ('04'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bits 1-7	Reserved (binary zero)	
Byte 2	Cylinder	Char(1)
	'00'-'4A'X (0-74)	
Byte 3	Head	Char(1)
	'00'X-'01'X	
Byte 4	Sector	Char(1)
	'01'X-(dependent on sector size, see below)	
Bytes 5-6	Unused	Char(2)

Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Unused	Char(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by the REQIO instruction execution.

If the address is invalid, the user is notified in the status field of the FBR and the device's former position is retained.

If the type field in the device specific area of the LUD specifies FM ('40'X or '2'C), the valid sector sizes and ranges are:

Size	Maximum Number Sectors/Track
128	26
256	15
512	8

If the type field in the device specific area of the LUD specifies MFM ('M'C), the valid sizes and ranges are:

Size	Maximum Number Sectors/Track
256	26
512	15
1024	8

FORMAT DISKETTE ('05'X)

The machine will reformat the entire diskette upon receiving this command.

The format of the RD is as follows:

Byte 0	Command ('05'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bits 1-7	Reserved (binary zero)	
Byte 2	Slot Number	Char(1)
	'01'-'17'X (1-23)	
Bytes 3-6	Unused	Char(4)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Unused	Char(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by REQIO instruction execution.

The slot number field identifies the slot containing the diskette to format. If the slot number specified is the current slot number, no carriage movement will occur. The valid range is 1-3 for the manual slots, 4-13 for magazine 1 slots 1-10, and 14-23 for magazine 2 slots 1-10. Whenever diskette formatting is requested, the entire diskette is formatted by writing valid identifier fields through all the sectors on the diskette. If any sector is bad, the cylinder is marked defective. The first step consists of formatting side 0 of cylinder 0, and writing the volume label on Sector 7. This label consists of 4 bytes of hex '40', followed by 24 bytes containing 'DISKETTE NOT INITIALIZED', followed by 100 bytes of hex '40'. This ensures an

existing volume label is cleared if more than two defective cylinders are encountered when formatting cylinders 1-76.

Following this step, cylinders 1-76 are formatted by writing cylinder X head 0 then cylinder X head 1. For 1-sided diskettes (specified in the LUD), formatting head 1 is ignored.

Following the cylinder formatting is the cylinder initialization pass. This will be done by writing worst case data in all sectors and verifying the write was successful. This sequence is repeated cylinder by cylinder for the entire diskette. If in writing a sector it is found defective, the cylinder is marked bad and the next cylinder is used. If more than two cylinders are bad or if cylinder 0 is bad or if none of the 'FF'X control records written on a bad track can be read, the diskette is bad. (The first three bad cylinders are noted in the bad cylinders field in the LUD Device Specific Area.)

Upon completion of these writes, the VOL header is written along with the ERMAP onto the VTOC area. The VOL is gotten from the device specific area of the LUD. The ERMAP is constructed.

If ASCII is specified in the LUD, the initialization data is written in ASCII. The VTOC information (VOL1, etc) is written in the ASCII equivalent. Note: the data in the LUD (Vol label, header label, etc) is always in EBCDIC.

INCREMENT DISKETTE ADDRESS ('0C'X)

The machine will cause the device to load the specified diskette into the machine.

The format of the RD is as follows:

Byte 0	Command ('0C'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bits 1-7	Reserved (binary zero)	
Byte 2	Slot Number	Char(1)
	0-23 ('00'X-'17'X)	
Bytes 3-6	Unused	Char(4)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Unused	Char(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by REQIO instruction execution.

If the slot number requested is the current slot, no carriage movement occurs. The valid range is 0, 1-3 for the manual slots, 4-13 for magazine 1 slots 1-10, and 14-23 for magazine 2 slots 1-10.

The current diskette is unloaded and placed into its appropriate manual slot or magazine slot, and the diskette requested is put into the machine.

If 0 is specified for the slot, the current diskette is unloaded and the carriage is positioned at the home position (manual slot 1) and no diskette is

loaded. The magazines are then in a position to be removed.

If a diskette is loaded, the command always results in a seek to cylinder 0.

ADDRESS ('18'X)

An RD specifying the address command returns the diskette address for the current position of the read/write heads.

The format of the RD is as follows:

Byte 0	Command ('18'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bits 1-7	Reserved (binary zero)	
Byte 2	Slot Number *	Char(1)
Byte 3	Cylinder Number*	Char(1)
Byte 4	Head*	Char(1)
Byte 5	Sector Number*	Char(1)
Byte 6	Sector Size*	Char(1)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Unused	Char(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by REQIO instruction execution.

The possible values returned in the slot number field are 0-23 ('00' - '17'X) and represent the slot number of the diskette loaded. If no diskette is loaded, the drive is in the home position (slot number 0) and the cylinder, head, sector, and sector size fields will be set to zero.

The other fields can have the following values:

Cylinder:	0-74 ('00' - '4A'X)
Head:	0-1 ('00' - '01'X)
Sector:	1- (dependent on sector size, see the seek to address command)
Sector Size:	'00'X - 128 byte sectors
	'01'X - 256 byte sectors
	'02'X - 512 byte sectors
	'03'X - 1024 byte sectors

Example: If the user started reading on diskette 13 (last diskette in magazine 1), written with 128 byte sectors, on cylinder 5, the primary side, starting with sector 1 for 8 sectors and then this command was issued, the values returned would be 0D05000900 in bytes 2-6. If the user issued a Seek to Address command and followed its completion with an Address command, the address returned would be the same address as the Seek command.

HALT ('1C'X)

The machine ceases to process REQIOs upon encountering this RD, returns a feedback record and processing is terminated. To restart processing, a user need only issue a REQIO continue.

The RD format is:

Byte 0	Command ('1C'X)	Char(1)
Bytes 1-6	Command Modifier	Char(6)
Byte 1	Control	Char(1)
Bit 0	Command Control*	
Bits 1-7	Reserved (binary zero)	
Bytes 2-6	Unused	Char(5)
Byte 7	Reserved (binary zero)	Char(1)
Bytes 8-9	Unused	Char(2)
Bytes 10-15	Reserved (binary zero)	Char(6)

*Fields modified by the REQIO execution.

4.4.4.2 Feedback Record and Error Recovery Procedures

The format of the feedback record is as follows:

Bytes 0-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU #	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for descriptions of the request address and request ID fields.

The Error Summary field defines the status of the REQIO as generically defined in the REQIO

instruction description. The specific values possible for the 72MD are itemized in Table 1 which follows.

The RD number is the index of the last RD processed, or the RD in error, if an error is indicated.

The RIU segment count field is unused by the Mariner and is set to binary zeros.

The device dependent area is all binary zero unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction. If the device dependent data is present, the fields have the following definitions.

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered.

The time stamp and OU# are the same values present in the hardware error log entry and are used to correlate the FBR and the error log entry for maintenance purposes.

Table 1 lists the error summary, device dependent error codes, the hardware error log codes, what caused the problem, and the recommended recovery action. If the error is the result of a load/dump operation, only the last byte of the error summary field will be as shown. This is concatenated with the load/dump code, resulting in the error summary returned with the load/dump feedback record and itemized in the load/dump description.

Table 1: 72MD Error Summary Values

Error Summary	Dev Dep Error Code	Hardware Error Code	Meaning	Recovery Action
X'0000'	N/A	N/A	No error condition	N/A
X'0008'	N/A	N/A	Req I/O continue completion	N/A
X'C009'	N/A	N/A	Part processed request, term due to reset session.	An activate must be issued to re-start processing or a deactivate must be issued to destroy the session An activate must be issued to restart processing or a deactivate must be issued to destroy the session.
X'C00A'	N/A	N/A	Unprocessed request, due to reset session	The LUD must be varied off to clear this condition. A partial damage event has also been signaled. The MODLUD reset, deactivate, vary off, vary on and activate functions must be issued to restart processing. A REQIO continue is needed to start processing A REQIO continue is needed to start processing
X'C00B'	N/A	N/A	IOM Partial Damage	
X'C010'	N/A	N/A	REQIO rejected due to device OU task failure.	
X'C016'	N/A	N/A	End of file	
X'C017'	N/A	N/A	End of volume	
X'E041'	1001	N/A	SSD destroyed	Provide a correct SSD, perform any higher level recovery if necessary for any data which may have been lost, then reissue REQIO and issue a REQIO-continue.
	1002	N/A	SSD truncated or suspended	
	1003	N/A	SSD damaged	
X'C042'	N/A	N/A	Invalid data format EBCDIC to ASCII specification error	Attempted to read the VTOC with an improper data format. Redefine the device parameters approximately and re-issue the read operation.
X'C043'	N/A	N/A	Invalid buffer alignment	Allocate the SSD to be page aligned, reissue REQIO and issue a REQIO continue Make a smaller request or make the SSD larger, perform any higher level recovery if necessary for any data which may have been lost, then reissue REQIO, and issue a REQIO continue Fix SSD pointer with a valid pointer, reissue REQIO, and a REQIO continue to restart processing Fix value in function field, reissue REQIO and issue REQIO
X'C044'	N/A	N/A	SSD area too small	

Table 1: 72MD Error Summary Values

Error Summary	Dev Dep Error Code	Hardware Error Code	Meaning	Recovery Action
				continue User may have only 1 read or write cmd per REQIO. Fix and reissue REQIO and issue a REQIO continue to restart N/A.
X'C084'	N/A	N/A	Invalid pointer to SSD	
X'C085'	N/A	N/A	Invalid function field	
X'C088'	N/A	N/A	Invalid RD sequence	
X'4089'	N/A	N/A	REQIO continue rejected due to a normal REQIO currently being processed	
X'D0CF'	N/A	N/A	Halt RD encountered in RD sequence	Issue a REQIO continue to restart processing.
X'F0DF'	N/A	X'0101'	Unrecoverable error due to a channel error	User should reset and terminate the session. Job may be restarted. If the error persists, call the CE. The LUD failure event is also signaled.
		X'0504'	Channel error on read sense during channel ERP	
X'D0EF'	N/A	N/A	VTOC command has been executed	Issue a REQIO continue to restart.
X'E010'	X'0001'	X'0107'	One sided media in drive	Request is invalid for a 1 sided IGAR diskette. Check request to see if logic is correct. A REQIO continue is needed to restart processing.
X'E010'	X'0003'	N/A	Device cover open	Close cover, reissue REQIO, and issue a REQIO continue to restart processing.
X'E010'	X'0007'		Diskette defective.	Replace diskette. Issue a REQIO continue to restart.

Table 1: 72MD Error Summary Values

Error Summary	Dev Dep Error Code	Hardware Error Code	Meaning	Recovery Action
X'E010'	X'0009'	X'0403'	-Read CRC ERR	User action based on status. Issue a REQIO continue to restart. The machine will be positioned at the first sector beyond the failing sector.
		X'0404'	-Write/veri- fy CRC ERR	
		X'0405'	-Read ID CRC Err	
		X'0406'	-Write/veri- fy ID CRC ERR	
		X'0407'	-Not ori- ented 1	
		X'0408'	-Not ori- ented 2	
			I/O error- media	
X'E010'	X'000A'	X'0403'	-Read CRC ERR	Operation will continue if REQIO in error is resent and a REQIO continue is sent to restart processing. Note that this sequence may have to be repeated as many times as there are sectors specified to be processed.
		X'0404'	-Write/veri- fy CRC ERR	
		X'0405'	-Read ID CRC Err	
		X'0406'	-Write/Veri- fy ID CRC ERR	
		X'0408'	-Not ori- ented 2	
		X'0407'	Non-sequen- tial sector sequence detected (not ori- ented 1)	
X'E010'	X'000B'	X'0303'	Failed to pick a diskette (AL Motion check)	A diskette was not at slot number requested or the hardware is malfunctioning. If a diskette is located at the slot requested call the CE.
X'E010'	X'000F'	X'0108' or N/A	CTRL addr mark with seq sector relocation found or a deleted sector was found. Note that the error log code is not appli- cable if a deleted sector is found, since an error log entry is not made	The machine will be positioned at the first sector beyond the failing sector. Reissue REQIO in error and a REQIO continue.

Table 1: 72MD Error Summary Values

Error Summary	Dev Dep Error Code	Hardware Error Code	Meaning	Recovery Action
X'E010'	X'0010'		for this condition.	Call CE. The current position of the diskette is indeterminate. The LUD failure event is also signaled.
			I/O error-	
		X'0100'	hardware	
		X'0101'	-OP PGM Err	
			-OU task	
			failure	
		X'0103'	-Overrun	
		X'0104'	-Disconnect	
		X'0105'	-Parity Err1	
		X'0106'	-Parity Err2	
		X'0107'	-CMD Reject	
		X'0108'	-CTL addr	
			mark	
		X'0201'	-Wrap error	
		X'0202'	-AL parity	
			error	
		X'0203'	-INV AL func	
			code	
		X'0204'	-FOB timeout	
			AL CMD	
		X'0205'	-Erase cur-	
			rent error	
		X'0206'	-AL CMD rej	
			MOD 'D'	
		X'0207'	-WRT gate	
			error	
		X'0208'	-FOB timeout	
			non-AL CMD	
		X'0301'	-AL motion	
			check	
		X'0302'	-AL motion	
			check	
		X'0303'	-AL motion	
			check	
		X'0304'	-AL motion	
			check	
		X'0306'	-AL CMD rej	
			(not ori-	
			ented)	
		X'0307'	-AL CMD rej	
			(out of seq	
		X'0405'	-IDCRC err	
			on read	
			data	
		X'0504'	-Read sense	
			error	
		X'0505'	-Inv B/D	
			stat data	
		X'0506'	-Unexpected	
			B/STAT on	
			RD Sense	
		X'0507'	-AL PAR ERR	
			on RD sense	
		X'0508'	-Retry stack	
			limit ex-	
			ceeded	
		X'050C'	-Can't flag	
			bad cyl	
			(format)	
X'E010'	X'0011'	X'0108'	CTRL addr	User decided action. The machine will be

Table 1: 72MD Error Summary Values

Error Summary	Dev Dep Error Code	Hardware Error Code	Meaning	Recovery Action
			mark with non-seq sector re- location found	positioned at the first sector beyond the failing sector. Issue a REQIO continue to restart.
X'E010'	X'0012'	X'0308'	Speed Check	Check diskette. If in backward correct, reissue failing REQIO, and issue a REQIO continue to re- start. If in correctly, the hardware is failing--call the CE.
X'E010'	X'0013'	X'040A'	No record found. The diskette mode (FM or MFM) is different than speci- fied by user	User decided action. The current position of the diskette is indeterminate.
		X'0308' X'0309'	Speed check Cylinder/ head/sector size mis- match. Value in RD does not match that found on diskette.	
X'E010'	X'0014'	N/A	Device cover open during error re- covery.	Message to close cover and restart job.
X'E014'	X'0004'	N/A	No diskette loaded	Issue an increment command, the REQIO that got the error, and a REQIO continue to restart processing
X'E087'	X'0002'	N/A	Rd/wr of VTOC area attempted with control bits not set	Cmd modifier bits must be on to do a read or write on the VTOC. Correct, reissue REQIO, and a REQIO continue to restart processing
X'E087'	X'0005'	N/A	Seek address invalid	Fix the RD, reissue REQIO and issue a REQIO continue
X'E087'	X'0006'	N/A	Diskette slot number invalid	Fix the RD, reissue REQIO and issue a REQIO continue
X'E087'	X'0008'	N/A	Invalid Command	RD cmd should be replaced with proper cmd, reissue REQIO, issue a REQIO continue to restart processing.
X'E087'	X'000C'	N/A	No sectors specified or number of sectors specified	Fix the RD, reissue REQIO and issue a REQIO continue.

Table 1: 72MD Error Summary Values

Error Summary	Dev Dep Error Code	Hardware Error Code	Meaning	Recovery Action
X'E087'	X'000D'	N/A	is equal to RD bytes 3-4 Too many sectors or no sectors to write with VTOC command	Fix the RD, reissue REQIO and issue a REQIO and issue a REQIO continue.
X'E087'	X'000E'	N/A	VTOC write buffer did not start with VOLL or VTOC data read did not contain a VOLL in either EBCDIC or ASCII	Fix the buffer area, reissue REQIO and issue a REQIO continue or issue message stating that the diskette is improperly formatted.
X'E087'	X'0015'	N/A	Reserved fields in RD not zero.	Fix the RD, reissue REQIO and issue a REQIO continue.

TABLE 2: FEEDBACK SUMMARY BY RD COMMAND

FEEDBACK ERROR SUMMARY	WRITE			READ			CONTROL				
	D	V	I	D	V	I	S	F	I	A	H
	A	T	P	A	T	P	E	R	N	D	A
	T	O	L	T	O	L	E	M	C	D	L
	A	C		A	C		K	T	R	R	T
0000	X			X			X	X	X	X	
0008											
4089											
C009	X	X	X	X	X	X	X	X	X		
C00A	X	X	X	X	X	X	X	X	X	X	X
C010	X	X	X	X	X	X	X	X	X	X	X
C016				X							
C017	X			X							
C042					X						
C043	X		X	X		X					
C044	X	X	X	X		X					
C084	X	X	X	X		X					
C085	X	X	X	X	X	X	X	X	X	X	X
C088	X	X	X	X	X	X					
D0CF											X
D0EF		X	X		X	X					
E010 0001	X	X		X	X		X	X			
E010 0003								X	X		
E010 0007								X			
E010 0009	X	X	X	X	X	X					
E010 000A	X	X	X	X	X	X					
E010 000B				X		X		X	X		
E010 000F				X	X	X					
E010 0010	X	X	X	X	X	X	X	X	X		
E010 0011				X	X	X					
E010 0012	X	X	X	X	X	X	X				
E010 0013	X	X	X	X	X	X	X	X			
E010 0014	X	X	X	X	X	X	X	X			
E014 0004	X	X	X	X	X	X	X				
E087 0002	X			X							
E087 0005							X				
E087 0006								X	X		
E087 0008											
E087 000C	X			X							
E087 000D		X									
E087 000E		X			X						
E087 0015	X	X	X	X	X	X	X	X	X	X	X
F0DF	X	X	X	X	X	X	X	X	X		
ALL OTHER CODES											
	A N Y C O M M A N D										

4.4.4.3 End of Volume Handling for Data Interchange

In processing a multivolume file, a specific sequence must be adhered to. The following, lists this sequence:

1. The REQIO with the FBR marked as EOVS shall be returned to the user. This FBR is a "terminating" FBR case.
2. The processing of REQIO's shall stop as with any terminating condition.
3. User must construct the REQIO necessary to address to the next diskette (ie, increment, read VTOC, etc).
4. The REQIO (in #3) will have a request priority less than any other REQIO's issued and awaiting processing.
5. The REQIO is issued (sent) to be processed.
6. A REQIO continue must be issued to start processing.
7. The Request I/O from Step 3 will be the first one processed due to its lower key value. This Request I/O, since it will read cylinder 0, is

special and will result in a FBR marked as "terminating" which will again stop processing of further requests.

8. Steps 3-7 shall be repeated until the proper diskette is retrieved.
9. The device specific area (the VOL and HDR information) is updated if needed to reflect the attributes of the new diskette media.
10. Any REQIO's necessary to seek to a starting point are constructed (with a lower request priority than any previous) and are sent.
11. The REQIO which caused the EOY condition is resent with a request priority lower than any outstanding requests. No modifications to this REQIO need to be made - processing will pick up from where Step 1 left off.
12. A REQIO continue is issued and processing resumes.

4.4.4.4 End of Volume Handling for L/D

L/D end of volume processing is handled like that for data interchange (see Section 3.1.2.3.1.3) except that the user must either use MODLUD to switch into data interchange mode or use the L/D override settings in the function field of the REQIO for steps 9 and 11.

4.4.5 EVENTS AND EXCEPTION CODES

4.4.5.1 Events

The following events are also signaled by 72MD device management. For a complete description of the following events, see Chapter 8 of this document.

LUD Contact Event (000B 06 01)

This event is signaled by the MSCP when VARY ON Processing is completed. See MSCP Section 5.1.2 and Event Section 8.1.2 for details. Subtype 01 is signaled upon successful contact; however, subtype 02 (unsuccessful contact) is never signaled for this device. In these cases, the MODIFY LUD (VARY ON) instruction signals an exception instead.

LUD Failure Event (000B 08 01)

This event will be signaled if the device should not be used anymore until the problem is corrected. The event will be signaled for any errors that have a recovery action of calling a CE. As part of the recovery action for this event, the LUD should be varied off before attempting further operations.

The event related data consists of:

Bytes 0-1	Hardware Error Code which further defines the specific error encountered. An error log record has also been made for this error using this same hardware error code. For this event, only the codes which are listed in Table 1 of Section 4.4.4.2 (Feedback Record) under the error summary codes FODF and E0100010 and hardware error code 050A will be provided for this event (approximately 32 codes).
Bytes 2-9	Error Log Timestamp.
Bytes 10-11	OU Number = '0012'X.
Bytes 12-13	Optional Data = Not used.

REQIO Complete Event (000B 09 01)

The REQIO complete event will be signaled if the user requests it. See the REQIO instruction for details.

REQIO Response Queue Destroyed Event (000B 0A 01)

This event is signaled if the user truncates or destroys the Request I/O Response Queue while the machine is processing REQIOs.

4.4.5.2 Exception Codes

The following table provides a summary of the cases where the S/S Resource Not Available exception ('3404'X) will be signaled when a MODIFY LUD instruction is executed for the 72MD LUD:

COMMAND	EXCEPTION DATA		
	GENERIC	SPECIFIC-CODE	
VARY ON	'2302'X	'0001'X	I/O failure has occurred. LUD failure event has been signaled.
		'0204'X	A correctable condition 'cover open' at the device is preventing device initialization for Vary On processing.
ACTIVATE SESSION	'2303'X	'C4C0'X	Invalid storage pool specification for a Load/Dump session.
RESUME SESSION	'2311'X	'0001'X	I/O failure (OU task failure) has occurred. LUD failure event has been signaled.
SUSPEND SESSION	'2312'X	None	Not signaled.
QUIESCE SESSION	'2313'X	'1302'	Quiesce rejected due to a terminating error condition existing.

DEVICE SPECIFIC AREA	'2300'X	None	Exception not signaled for this case.
----------------------------	---------	------	---

4.5 3410/3411 TAPE DEVICE

The 3410/3411 tape device may be used for either load/dump or data interchange magnetic tape operations. For load/dump operations, data compression/decompression is supported.

The following IBM standards apply to magnetic labels:

- I-S 3-8010-103 Standard Magnetic Tape Labels
- I-S 3-8010-003 Standard Volume Labels

4.5.1 PROGRAMMING CONSIDERATIONS

Each tape drive requires a LUD (type 10) object to be created for its support. A CD (type 00) object must be created for the tape subsystem. These system objects must be created and initialized via the CRTLUD and CRTCD instructions. There must be enough space reserved in each LUD for the device specific parameters needed by the machine. The device specific parameters control the processing performed during an active session.

A REQIO must be preceded by the activate session function of MODLUD. REQIO will then cause data to be transferred to or from the tape media.

4.5.2 CREATE CONTROLLER DESCRIPTION (CRTCD)

The identified fields in the CREATE CD template must be initialized for the 3411 tape controller as indicated: Note: All fields hex zero unless indicated below.

```

CD Type:           '00'C
Unit Type:         '3411'C
Model Number:      '0001'C for 12.5 inch
                   per second tape drives
                   '0002'C for 25 inch per
                   second tape drives
                   '0003'C for 50 inch per
                   second tape drives
Physical Address (CD OU#): '0015'X
Power Control:      '0100'X
Station Control
Information:         All binary zero
Selected Mode Data: All binary zero
Activate Physical Unit
Information:         All binary zero
Dial Digits:        All binary zero
Specific Characteristics
Length:             '0000'X
XID Information Length: '0000'X
Unit Specific Contents Length: '0000'X

```

4.5.3 CREATE LOGICAL UNIT DESCRIPTION (CRTLUD)

The following fields must be initialized as indicated for the 3410/3411 tape devices: Note: All fields hex zero unless indicated below.

```

LUD Type:           '10'C
Device Type:        '3410'C
Model Number:       '0001'C, '0002'C, or
                   '0003'C which must match
                   the model numbers of the
                   controller to which this
                   LUD is attached
Forward Object Pointer: Pointer to CD
Physical Address:
  LU Address:       '0000'X, '0001'X,
                   '0002'X or '0003'X
  CD OU#:           '0015'X
Power Control:      '0000'X
Session Definition Data: all binary zero
Load/Dump Definition Data:
  Load/Dump Device  '00'X Not used as a
                   L/D Device
                   '01'X Load/Dump device
                   - noninterruptible
                   - nonexchangeable
                   '21'X Load/Dump device
                   - exchangeable
Operating Mode      (Restricted to the
                   following values at
                   CREATE LUD time)
                   (See Section 4.5.5
                   Modify Load/Dump
                   Indicator)
                   '00'X Normal
                   '01'X Load Mode-Primary
                   '02'X Dump Mode-Primary
Remaining L/D fields:
(See Section 4.5.3 -
MODLUD L/D Indicator)
Specific Characteristics
Length:             '0000'X
Retry Value Length: '000C'X
Tape Retry Values:  See below
Error Threshold Length: '0010'X
Tape Error Threshold
Values:             See below
Device Specific Length: 90
Device Specific Modifiable
Length:             86
Device Specific Parameters: See below

```

Tape Retry Values:

Error Type	Error Description	Retry Value
X'0001'	I/O Error, 3411 I/O Check, Data Check and Read Command (number of passes - 5 forward and 5 backward reads per pass)	Value (10-20) Suggested value=10
X'0002'	I/O Error, 3411 I/O Check, Data Check and Write Command	Value (15-30) Suggested Value=15

Tape Error Threshold Values:

Error Type	Error Description	Threshold Value
------------	-------------------	-----------------

X'0001' I/O Error, 3411 I/O Value (1-10)
Check, Data Check and Suggested =5
Read Command

X'0002' I/O Error, 3411 I/O Value (1-64)
check Data Check and Suggested Value=32
Write Command

Device Specific Parameters:

Bytes 0-5	Active Session Flags	Char(6)
Byte 0		Char(1)
Bit 0	Tape encoding	
	0 - EBCDIC tape;	
	1 - ASCII tape	
Bit 1	Tape density	
	0 - 1600 BPI	
	1 - 800 BPI	
Bits 2-7	Reserved (binary zero)	
Bytes 1-2	Reserved (binary zero)	Bin(2)
	Note: Bytes 1 and 2 are common reserved areas in 72MD, 3410 and 3430 LUDs.	
Byte 3	Reserved (binary zero)	Char(1)
Bytes 4-5	Load/Dump Block Counter	Char(2)
	Updated by the number of blocks transferred	
Bytes 6-85	Volume Label	Char(80)
Bytes 86-89	Reserved (binary zero)	Char(4)

The first 86 bytes of the Device Specific Parameters (the active session flags and volume label fields) are modifiable through MODLUD.

For proper logging of volume SDRs, each time that a different tape is mounted there must be a device specific area change message issued through MODLUO. This would normally be required anyway to update the Block Length and Volume Label fields.

For loading or dumping of Load/Dump tapes, a maximum block size of 31744 bytes will be supported.

4.5.4 MODIFY CONTROLLER DESCRIPTION (MODCD)

The following is a list of functions the 3411 tape controller supports through the MODCD instruction.

POWER ON
POWER OFF
VARY ON
VARY OFF
SET DIAGNOSTIC MODE
RESET DIAGNOSTIC MODE

Refer to the Modify CD instruction for the meaning and use of each function.

Modify CD - Reset Diagnostic Mode

For 3410 tape controller, a MODCD Reset Diagnostic Mode is used to return the Controller Description to

Power On or Power Off state from Diagnostic state. In so doing, MODCD sends a "power status" request to the tape controller to determine its power status. If the tape controller is powered on, the Controller Description is set to Power On state; if it is powered off, the Controller Description is set to Power Off state. If the power status failed to determine its status, MODCD attempts to power off the controller; if this is successful, the Controller Description is set to Power Off state; if not, it is left in Diagnostic state.

Inasmuch as a successful Reset Diagnostic mode may leave the Controller Description in either Power On or Power Off state, this can cause some difficulty in using programs which might assume that it will be in Power Off state on completion of the Reset Diagnostic mode. To minimize this difficulty, if the using program specifies a Reset Diagnostic mode and Power On request on one MODCO instruction, the MODCD code will honor the combination as successful if the Reset Diagnostic Mode succeeded and set the controller to Power On state - in this particular case, the Power On part of the request is honored as if executed, and no Object state Invalid exception is raised.

4.5.5 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

The following is a list of functions the 3410/3411 tape device supports through the MODLUD instruction.

VARY ON
VARY OFF
ACTIVATE
DEACTIVATE
SUSPEND
QUIESCE
RESET
RESUME (activate after suspend, quiesce or reset)
ERROR THRESHOLD SETS
RETRY VALUE SETS
LOAD/DUMP INDICATOR
DEVICE SPECIFIC CONTENTS

Refer to the Modify LUC instruction for the meaning and use of each function.

The device specific area of the LUD (that portion that is modifiable) may be altered at any time. It should be noted that any changes to the device specific area are reflected in the machine's processing. For this reason, the area should be altered prior to beginning the processing of the tape media and not during processing. Changes in tape density will only be effective if the tape is positioned at load point.

The machine maintains a copy of the Load/Dump block counter. The value in the device specific area is copied when the LUD is varied on and when there is a device specific area change and is updated whenever a Load/Dump message is returned. This requires the user to initialize the counter and avoid making any device specific area changes while a Load/Dump message is outstanding.

Modify Load/Dump Indicator

Operating the 3410 tape devices for load/dump media operations is performed by modifying this field in the 3410 LUD. The allowable operations are controlled by whichever value was selected for the Load/Dump Device field at CREATE LUD time.

1 Load/Dump Device - '00'X (Not used for L/D operations)

No further operations for the Load/Dump indicator field are allowed.

2 Load/Dump Device - '01'X (L/D device--noninterruptible nonexchangeable)

- Operating Mode This field may be set to one of the following:
 - '00'X Normal Mode (data interchange)
 - '01'X Load Mode
 - '02'X Dump Mode

All remaining fields within L/D Indicator are not used.

3 Load/Dump Device '21'X (L/D device--exchangeable)

- Operating Mode This field may be set to one of the following:
 - '00'X Normal Mode (Data interchange)
 - '01'X Load Mode--Primary device for exchanges
 - '02'X Dump Mode--Primary device for exchanges
 - '21'X Load Mode--Alternate device for exchanges
 - '22'X Dump Mode--Alternate device for exchanges
- Load/Dump Pending Field Set to binary zero. Not used for exchange operations.
- Corresponding Primary Address Address This field may be set to one of the following:
 - '0000'X Whenever operating mode is
 - '00'X Normal
 - '01'X Load Primary
 - '02'X Dump Primary
 - '0000'X
 - '0001'X Whenever operating mode is

'0002'X '21'X Load--Alternate
'0003'X '22'X Dump--Alternate

In these cases, this field specifies the LU address of whichever other 3410 LUD is operating as the primary device corresponding to this alternate device for exchange operations.

- Load/Dump Exchange Status

If operating in normal mode (data interchange) this field is not used (binary zero). If operating in any of the Load or Dump modes, this field is used to indicate or change which of the LUDs is currently allowed to process Load/Dump Request I/O instructions.

On MATERIALIZE LUD:

'000000'X - This device is 'not current'
'010000'X - This device is 'current'

On MODIFY LUD:

'000000'X - No modification requested

'010000'X
'010001'X Modify this LUD to become 'current'
'010002'X Where the last current device is
'010003'X The LUD with LU address '0000'X, '0001'X, '0002'X or '0003'X (whichever is specified). The other LUD is modified to 'not current'.

- Load/Dump Buffer Storage Bin(2) This field is used to specify the amount of buffer storage which L/D is allowed to extract from the user's process storage pool. This value is specified in units of minimum transfer size for the machine (512 bytes). Values can range from 64 to 256 (for buffer sizes from 32K bytes to 128K bytes).

- Load/Dump Process Priority Char(1) This field can be used to specify the relative priority at which the internal Load/Dump processes will run. A value of zero specifies the highest priority. This parameter allows the

L/D to contend with other concurrent user processes in a manner where L/D has very little impact on other processes or conversely where L/D performance itself experiences very little impact.

Modify LUD (Vary Off)

For the 3410 tape device to support the rewind or rewind and unload commands with immediate response (as defined in Section 4.5.6.1), the IOM may require up to four minutes to complete a MODLUD (vary off) operation in order that the physical rewind is allowed to complete before varying off of the device. The user of MODLUD (vary off), where rewind operations with immediate response may still be outstanding, must ensure that his MODLUD timeout value is sufficiently long to allow the rewind to complete or a partial damage (timeout) exception condition will result.

An automatic rewind and unload is issued to the corresponding device when processing a MODLUD (vary off). This is done to try and prevent inadvertently powering down the tape subsystem while a tape is still loaded which could cause physical damage to the tape itself.

4.5.6 REQUEST I/O INSTRUCTION (REQIO)

The REQIO instruction is used to send I/O requests to the device.

The SSR for a REQIO to one of the tape drives contains the following values:

S/S Object	- Pointer to the corresponding tape LUD
Response Queue	- Pointer to response queue
S/S Data Area	- Space Pointer
Optional Pointer	- Reserved (binary zero)
Request Priority	- See Volume III, S/S REQIO
Request ID	- See Volume III, S/S REQIO
Function Field	- '80'X
Control Field	- 'N' or 'C'
Key Length	- Bin(2)
Key Offset	- Bin(2)
RD Count	- See below
RD Offset	- Bin(2)

At least 1 Request Descriptor (RD) must exist with each REQIO (except Continue) or a template value invalid exception will be returned. A REQIO Continue must have an RD Count=0. Only 1 read or write RD may exist per REQIO. Any number of the other RDs may exist with or without a read or write RD.

All label processing must be done by the user. The machine will not check for this. An example is the sequence of trailer labels which must be issued to the machine in accordance with the tape standards specification.

The device specific area in the LUD must specify ASCII encoding when the tape is encoded (or is to be encoded) in ASCII. The machine will convert the data to/from ASCII from/to EBCDIC.

4.5.6.1 Request Descriptor

The RD format is as follows:

Byte 1	Command	Char(1)
	'02'X - read block	
	'01'X - write block	
	'12'X - read block backwards	
	'14'X - forward space block	
	'1C'X - backward space block	
	'24'X - forward space file	
	'2C'X - backward space file	
	'34'X - rewind with delayed response	
	'35'X - rewind with immediate response	
	'B4'X - rewind and unload with delayed response	
	'B5'X - rewind and unload with immediate response	
	'54'X - write tape mark	
	'4C'X - tape clear	
	'0A'X - check tape	

Byte 1	Control*	Char(1)
Bit 0	0=Process RD 1=Do not process RD	
Bit 1	0=Wrong length record was not detected 1=Wrong length record was detected	
Bit 2	0=Return error if wrong length record detected 1=Do not return error for wrong length records	
Bit 3	0=Volume is not write protected 1=Volume is write protected	
Bits 4-7	Reserved (binary zero)	

Bytes 2-3	Operation Performed*	Bin(2)
Bytes 4-5	Block Size Detected*	Bin(2)
Byte 6	Reserved (binary zero)	Char(1)
Byte 7	Reserved (binary zero)	Char(1)
Byte 8	Tape Density*	Char(1)
Byte 9	Number of operations to perform	Char(1)
Bytes 10-11	Block Size 18-32768 bytes	Bin(2)
Bytes 12-15	Reserved (binary zero)	Bin(2)

*These fields are modified by the REQIO execution.

The Command field indicates the type of operation to be performed. The specific commands are described later.

The Control field specifies certain actions to be taken in processing the RD.

Bit 0 of the Control field indicates whether or not this RD is to be processed or not. A zero in this field means the RD is to be processed and a binary one means the RD should not be processed. This field will be set to a binary one by the machine when the RD is successfully completed. After normal completion, this field must be reset by the user before the RD can be reused. (Note: Processed Read/Write RD's will still be used in calculating the buffer address for following Read/Write RD's.)

Bit 1 of the Control field indicates whether or not a wrong length record was detected by the read command associated with this RD. If this bit is set to a binary zero the record read was the same size as that specified. If this bit is set to a binary one the record read was not the same size as specified.

Bit 2 of the Control field indicates the action to be taken for wrong length records. If this bit is set to a binary zero and a wrong length record is encountered, processing will stop and an error will be returned in the feedback record. If this bit is set to a binary one and a wrong length record is encountered, processing will continue with the next RD. If the Operations to Perform field contains a value other than one, this bit will be ignored.

Bit 3 of the Control field indicates whether or not the volume currently mounted is write protected. A binary 1 in this field indicates that the volume is write protected.

The Operations Performed field indicates the number of operations which completed satisfactorily before the command ended. The field is normally set to zero before issuing the REQIO. The field is then incremented as operations are completed successfully. This field in conjunction with the Control field of previously processed RDs can be used to reissue a REQIO after an error.

Note: When a wrong length record is encountered this field will not include the block just read even if the suppress wrong length bit (RD byte 1 bit 2) is on.

The Block Size Detected field indicates the block size read if the block size is less than the block size specified. If the block size read is greater than the block size specified, the block size detected will be zero. This facilitates the reading of a "stranger" tape in that the maximum block size can always be specified and this field will return the actual size of the block read.

The Tape Density indicate the density of the tape where 'CB'X represents 800 BPI and 'C3'X represents 1600 BPI. This field only has meaning for the Check Tape command.

The Number of Operations to Perform field contains the number of blocks/files/ tape marks to read/write/space. This must be greater than zero.

The Block Size field indicates the size of the block or blocks to read or write. This must be greater than or equal to 18 and less than or equal to 32,768.

The Number of Byte in Error field contains the number of the byte within the block indicated in the Number of Block in Error field which has bad data (associated with the data not valid error X'C042').

THE RD COMMANDS

The following are the commands supported in the REQIO instruction:

Read Block ('02'X)

With this command the user may specify up to 255 blocks to read. If the number specified is 0, an error will be returned. The number specified must not be greater than what the source/sink data area buffer will hold, ie, block count times block size (with the block size rounded up to a multiple of eight) must be less than or equal to buffer size or an error will occur. The data area used must be double word aligned unless the block size to read is greater than 32256 in which case the buffer must be page aligned. Page alignment is recommended even for block sizes less than 32256 to obtain increased performance. For normal and error completions, the operations performed field indicates the number of blocks read in. If an I/O error occurs, the machine will retrieve as much data from the block as possible. (This does not include trying to read the block in both directions.) If a tape mark is encountered, an error will be returned.

If in retrying a read of a bad block, the read operation completes successfully, the machine will continue processing. If the error cannot be corrected, the operation stops, the machine returns as much data as possible, and an error is indicated. The tape is positioned so the read head is positioned after the block that caused the error.

Whenever the block size detected is different than that specified in the RD, the Block Size Detected field will be set by the machine. When the block size detected is smaller than specified, the Block Size Detected field in the RD will be set to the actual size of the block read and the unused area of the user's buffer will be indeterminate. When the block size detected is equal to or larger than the size specified, the Block Size Detected field in the RD will be set to zero.

An error will be returned when a wrong length record is detected if Bit 1 of the RD Control field is set to zero or the Operations to Perform field is set greater than one. The user may indicate that no error is to be returned for a wrong length record by setting Bit 1 of

the RD Control field to a binary one and specifying only 1 block of data be read per RD.

If a block is read and the block size is not a multiple of eight, the data will be transferred and the buffer padded with hexadecimal zeros until the block size is a multiple of eight. Padding is based on the specified block size, not the actual block size. For example, an 18 byte block will result in 18 bytes of data and 6 bytes of zeros.

If variable sized blocks are to be read and the size of the blocks is unknown, the maximum block size should be specified. The block along with an indication of its actual size will be returned to the user.

Tape density need not be specified for reading.
Tape encoding must be specified to ensure
proper operation.

Write Block ('01'X)

With this command, the user may specify up to 255 blocks to write. If the number specified is 0, an error will be returned. The number specified must not be greater than what the source/sink data area buffer holds, ie, block count times block size (with the block size rounded up to the next multiple of eight) must be less than or equal to the buffer size or an error will occur. The data area must be page aligned if the block size to write is greater than 32256 else the data area need only be double word aligned. For any condition, the user will be notified of the number of blocks written. If the end of tape marker is sensed when attempting to write a block, the block will be written and the user notified that this occurred.

Once the end of tape has been sensed, subsequent write commands which are issued with the tape positioned past the end of tape marker will continue to have this error indicated and only one block will be written per request. There is a remote possibility that the above will not occur if a recoverable error occurs in the vicinity of the end of tape marker. If this happens, the end of tape may only be indicated once. Subsequent write commands could cause the tape to run off the end of the reel.

If a write command results in an error and the machine, after retrying the command, successfully completes the operation, the machine will continue processing. If the error is unrecoverable, the operation stops and an error is indicated. The tape is moved until the write head is over the area just after the block that caused the error.

If a block of data is written and the block size is not a multiple of eight, the data bytes greater than the block size but less than the next multiple of eight are ignored. Tape

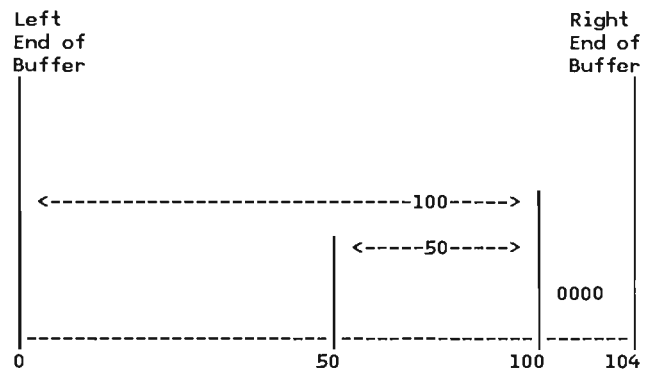
density and tape encoding must be specified in the LUD to ensure proper operation.

If the data is to be converted from EBCDIC to ASCII format, the data is copied from the SSD area to an internal buffer, then converted in the internal buffer.

Read Block Backward ('12'X)

This command is similar to the Read Block command except that the data is read from the tape while the tape is moving backward toward beginning-of-tape (BOT).

The user supplies the address of the 'left' end of the buffer, as with the Read Block command, but the data blocks are transferred into the user's buffer beginning at its calculated 'right' end, as described in the following example:



To read a data block with a block size of 100, would require 104 bytes of the user's buffer (100 rounded up to a multiple of eight). Bytes 101 to 104 would be padded with zeros. The data block would then be transferred into the user's buffer from right to left beginning at byte 100.

The user must realize that the order in which the data blocks are transferred into the user's buffer depends in part on the number of blocks read per RD. For instance, if three contiguous blocks (A, B, C) are read from tape with a single RD, they will be transferred into the user's buffer in a single operation and reside in the user's buffer in the same contiguous order (A, B, C) as they were on the tape. But if those same blocks are read one at a time using three RD's, they will be transferred into the user's buffer in three operations and reside in the user's buffer in the opposite order (C, B, A).

When the block size detected is smaller than specified, the unused buffer area will be indeterminate. For instance, if a block size of 100 was specified and the block size detected was 50, bytes 1 through 50 in the above diagram would be indeterminate.

When the block size detected is larger than the block size specified, the 'left' end of the block will be truncated rather than the 'right' end as with the Read Block command.

If the beginning-of-tape marker is encountered by this command, an error will be returned and the position of the tape will be at BOT.

Space Block and File Commands ('14'X, '1C'X, '24'X, '2C'X)

With this group of commands, the user may position the tape to a particular block or file relative to the current tape position. Up to 255 blocks or files can be spaced. A space or skip of 0 blocks or files results in an error response. In spacing forward or backward, the tape will stop beyond the block or file requested in the direction of travel. If when spacing forward, more blocks are requested than exist in the file and a tape mark is detected, an error is returned. In other words, if the tape is positioned in the inter-block gap before a tape mark and it is desired to have it positioned after the tape mark, a skip file command must be issued. If the same conditions exist but no tape mark is detected, an error is returned and the tape runs off the reel.

If more files than exist on the tape are requested while spacing forward, the tape runs off the reel and an error is returned. An example of a forward space block command is if the current position is after block one and the request is to move two blocks, the resulting position after processing will be after block three.

The forward space file command moves the tape forward and stops it immediately after the specified number of tape marks are sensed. For example, if the request is made to move forward two files, the machine will search for two tape marks and stop the tape when the second tape mark is sensed.

The backward space file command operates in the same manner as the forward space file command except the tape stops just after (in the direction of tape travel) the specified number of tape marks have been sensed or at the beginning of the tape, whichever comes first. An example of a backward space file command is, if the current position is in any file and the request is to move backwards one file, the resulting position after processing will be in the gap after the tape mark encountered in the direction of travel or at the beginning of the tape whichever occurs first.

Control ('34'X, '35'X, 'B4'X, 'B5'X)

With these commands, the tape can be rewound or reloaded. These commands position the tape at its beginning or put it in a state to be dismounted. If the command specifies delayed response, the request is not returned to the user until the operation completes. If the command specifies immediate response, the request is returned to the user when the operation begins unless other RDs follow this control command in the Request I/O. In this case processing of the other RD's will not take place until the operation actually completes.

Write Tape Mark ('54'X)

With this command, a special block is written on the tape that indicates the end of a tape file.

Tape Clear ('4C'X)

This command erases the tape from its current position to the end-of-tape marker. Any data past the end-of-tape marker will not be erased. Any data past the end-of-tape marker can be erased by repeatedly issuing this command. Each time this command is issued with the tape positioned past the end of tape an additional 3.6 inches of tape is erased.

Check Tape ('0A'X - IMMEDIATE RESPONSE, '0B'X - DELAYED RESPONSE)

Note: OB COMMAND SUPPORTED IN FEATURE GROUP 5

This command checks on the status of the specified tape drive. If the immediate response form of the command is used, the status will be determined and reported in a feedback record immediately according to the following table. If the drive is ready when the command is issued (either of the first two conditions in the table below) the density will be returned in RD byte 8 in the same format as in the LUD. Also RD control bit 3 will be set to a one if the volume is write protected. If the delayed response form is used, the status will be determined and the feedback record will be delayed only if the condition indicated is "searching for load point" in which case the feedback will be presented as normal but only after the search has ended.

This command also causes a mode set operation to the drive to set the tape density as indicated in the Device Specific Area of the LUD.

FEEDBACK ERROR SUMMARY

CONDITION	'0A'X (IMMEDIATE)	'0B'X (DELAYED)
- TAPE DRIVE READY AND AT LOAD POINT	'0000'X (NORMAL)	'0000'X (NORMAL)
- TAPE DRIVE READY BUT NOT AT LOAD POINT	E018 000C	E018 000C
- TAPE DRIVE BUSY SEARCHING FOR LOAD POINT	E014 0012	ED14 0012
- TAPE NOT MOUNTED ON DRIVE	E014 0D13	E014 0013
- START BUTTON ON TAPE DRIVE NOT DEPRESSED	E014 0008	E014 0008

DATA COMPRESSION

The 3410/3411 IOM will support RD indicators for data compression as defined within the Load/Dump Request I/O operations. The data compression will be accomplished by use of the SNA compression algorithm using string counts of 2-63 prime and 3-63 non prime characters and using prime compression character X'40'. Only software data compression is available for 3410/3411 devices. The HDC feature is not applicable to these devices.

There are no changes to the 3410/3411 configuration objects required in support of data compression/decompression.

4.5.6.2 Feedback Record

The feedback record (FBR) is the vehicle for signaling to the program that the functions requested in a REQIO instruction have completed, and whether they completed successfully or not.

The format of the feedback record is as follows:

Bytes 0-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for descriptions of the Request Address and Request ID fields.

The Error Summary field defines the status of the REQIO as generically defined in the REQIO instruction description. The specific values possible for the tape subsystem are itemized in Table 1 which follows.

The RD Number is the index of the last RD processed or the RD in error if an error is indicated.

The RIU Segment Count is the number of blocks, tape marks, or files transferred to or from the SSD by this request.

The Device Dependent area is all binary zero unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction. If the device dependent data is present, the fields have the following definitions.

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered. This code is also provided as event related data for the CD failure event or LUD failure event when these are also signaled.

The time stamp and OU# are the same values present in the hardware error log entry and the failure event data and are used to correlate the FBR, the event, and the error log entry for maintenance purposes.

Table 1 lists the device dependent status codes, what caused the problem and the recommended recovery action. If more than one error occurs, the error status returned will be returned on a worst condition basis. Example: For invalid block size detected and a tape media failure, the tape media failure condition will be returned as the status.

When the recovery action indicates that the tape job must be restarted, this must include a deactivate session.

Table 1: 3410/3411 Error Summary Values

Feedback Record Error Summary	Dev Dep Code	Hardware Error Codes	Meaning	Recovery Action
X'0000'	N/A	N/A	No error condition	N/A
X'0008'	N/A	N/A	Req I/O continue	N/A
X'C009'	N/A	N/A	Partially proc req, terminated due to reset	Activate must be issued to restart processing or a MODLUD deactivate must be issued to destroy the session
X'C00A'	N/A	N/A	Unproc req due to reset session on error	Activate must be issued to restart processing or a deactivate must be issued to destroy the session
X'C00B'	N/A	N/A	IOM Partial Damage	The LUD and CD must be varied off to clear this condition. Partial damage event(s) for CD and/or LUDs has been signaled.
X'C016'	N/A	N/A	Tape mark encountered	Issue REQIO continue for processing to resume
X'C017'	N/A	N/A	End of tape sensed	End of tape sensed during an I/O operation, issue REQIO continue to restart drive. (Note: continued use may cause tape to run off reel)
X'E041'	1001	N/A	SSD destroyed	Provide a correct SSD, perform any higher level recovery which is necessary since data may have been lost, then reissue REQIO, and issue a REQIO-continue.
	1002	N/A	SSD truncated or suspended	
	1003	N/A	SSD damaged	
X'C043'	N/A	N/A	Invalid buf alignment	Allocate SSD to the proper alignment, reissue REQIO, issue a REQIO continue
X'C044'	N/A	N/A	SSD area not large enough	Make smaller blocks or larger SSD, perform any higher level recovery which is necessary since data may have been lost, then reissue REQIO, and issue a REQIO continue
X'C084'	N/A	N/A	Invalid pointer to SSD	Correct pointer, reissue REQIO and issue a REQIO continue
X'C085'	N/A	N/A	Invalid function field	Correct the REQIO reissue REQIO and issue REQIO continue
X'C087'	N/A	N/A	Invalid RD	Correct the RD, reissue REQIO and issue REQIO continue
X'C088'	N/A	N/A	Invalid RD sequence	User may have only 1 Read or Write cmd per request
X'F0DF'	N/A		I/O Subsystem error	Subsystem error which affects all devices All tape jobs must be restarted. If attempted, recovery should Vary Off and Vary On CD. If error persists, call the CE. The C0 Failure Event is also signaled for these error cases.
		X'0000'	Note 1	
		X'4100'	cmd reject	
		X'1500'	channel over-run	
		X'1100'	channel error	
		X'2100'	IOC Errors	

Table 1: 3410/3411 Error Summary Values

Feedback Record Error Summary	Dev Dep Code	Hardware Error Codes	Meaning	Recovery Action
X'E010'	X'0001'	Parity X'4200' ABI Parity X'4300' ABO Parity X'4400' ABI Attach X'5100' IC error X'6100' Cmd reject X'1400' Chnl sequence X'5200' ABO error X'5300' Control error X'5400' Instr tag X'5500' ALU error X'5501' ALU error X'5600' ROS error X'5700' XFR error X'62XX' 3411 tag error X'8400' 3411 hdwe XX= DSTAT5		
		Subsystem failure Note 1 X'0000' Op pgm error X'1300' Cmd reject X'3100' cmd reject X'3300' Cmd reject X'3400' Initial error X'6300' Illegal cmd X'8800' Word count=0 X'8A00' Read sense X'E110' Stack overflow X'E120' IOM error X'E130' Read sense cmd X'E160' Inv B/D Stat X'E210' Disc-cmd fetch X'2300' Clear cmd X'E140' Mode set cmd X'E150' Reset cmd X'E170' FOB timeout X'E290' 3411 overrun X'C200' 3411 overrun X'B200'		Subsystem error affecting all devices. Position of tape indeterminable. If attempted, retry should include vary off and vary on CD. The CD failure event is also signaled for these cases. If the error persists, call the CE.
X'E010'	X'0002'	Tape drive failure Note 1 X'0000' Write errors X'B1XX' Read errors X'C1XX' Rej tape unit X'74XX' RB data check X'77XX' End vel check X'B600' Drive not attached X'8C00' Data Check-ERG X'B0XX' Bus out check X'B300' X'7100' Lamp check X'7600' Tach Check X'8900' Status Change XX= DSTAT15		Drive isolated failure. A permanent tape drive failure has occurred. Rerun the job using a different tape drive. The LUD failure event is also signaled for these cases. If attempted, recovery should include Vary Off and Vary On LUD. If the error persists, call the CE.

Table 1: 3410/3411 Error Summary Values

Feedback Record Error Summary	Dev Dep Code	Hardware Error Codes	Meaning	Recovery Action
X'E010'	X'0003'	X'C600' X'BF00' X'CC00' X'B500' X'7500' X'7800' X'7900'	Possible tape media failure NRZI-noise Data Check-ERG ERG noise Start vel ck Position check Tape Mark ck RB data check	Media error. Try a different tape or clean heads and columns If error persists, call CE.
X'E010'	X'0004'	X'8500' X'8501'	Enable/disable sw in disable position	Abort all tape jobs move switch to enable position and issue a Vary off CD followed by a Vary on CD.
X'E010'	X'0005'	X'8300' X'8301'	Subsystem pwr off	Vary off the tape subsystem and then issue a power off command for it. Power the subsystem back on and vary it on again. Rerun all jobs. If this error occurs again, a permanent failure has occurred.
X'E010'	X'0006'	X'8600'	Write ring is missing	Correct problem, reissue REQIO, and issue a REQIO continue.
X'E010'	X'0007'	X'8B00'	NRZI tape on PE only drive	Rerun the job on a device that has the dual density feature installed.
X'E010'	X'0010'	N/A	Invalid RD command	Fix RD and reissue REQIO, issue a REQIO continue.
X'E010'	X'0012'	X'7200'	Equipment Check	If all tape has run off the user's reel, check tape to be sure that an EOT marker is located about 25 feet from the end of tape. If none is present, attach one and rerun job. If EOT marker is present and error C017 has previously occurred, a program error is indicated. If all tape has not run off of user's reel, a permanent tape drive failure has occurred. Rerun the job using a different tape drive.
X'E010'	X'0014'	X'BA00'	PE ID burst error	Move BOT marker 2 CM and restart job.
X'E010'	X'0019'	X'B400' X'B700' X'B800' X'B900' X'BB00' X'BC00' X'BD00' X'BE00' X'C300' X'C400' X'C500' X'C700' X'C800' X'C900' X'CA00'	Possible tape media failure MTE/LRC VRC error CRC Parity NRZI write Phase error False end marker PE write error Data timing MTE/LRC error End data/CRC VRC error NRZI read Env/phase err False end marker Data timing	A retry may be attempted after doing a space block in the opposite direction of the failing command. If retrying is not successful, try a different tape or clear the heads and columns. If error persists, call the CE.

Table 1: 3410/3411 Error Summary Values

Feedback Record Error Summary	Dev Dep Code	Hardware Error Codes	Meaning	Recovery Action
X'E410' (note 2)	X'0020'	X'CB00'	PE read error	
		X'0000'	Media Format Error Detected while performing software decompression.	The tape on which read operations (Load/Dump only) are being attempted does not meet the requirements for the decompression operation. Mount a proper tape.
X'E014'	X'0008'	X'8100'	At load point but not ready	Make the drive ready and restart the job
X'E014'	X'0012'	X'8200'	Tape busy - searching for load point	Wait, reissue command and REQIO continue
X'E014'	X'0013'	X'8100'	Tape not mounted on drive or not ready and not at load point	Mount the tape make the drive ready and restart the job
		X'7300'	Ready Reset	
X'E018'	X'000A'	X'8700'	Tape moving backward at BOT	Check program to verify correct coding and issue a REQIO continue
X'E018'	X'000B'	N/A	Wrong length record detected by device	If unexpected, check command modifier for correct block size, issue a REQIO continue.
X'E018'	X'000C'	N/A	Tape mounted and ready but not at load point	Issue rewind command and REQIO continue
X'E087'	X'000D'	N/A	Invalid block size specified block size <18 or block size >32768	Correct blk size, reissue REQIO, and issue a REQIO continue
X'E087'	X'000E'	N/A	Block count to read/write not given(ie,zero) or block count given equals RD bytes 3-4	Insert blk count, reissue REQIO, and issue a REQIO continue
X'E087'	X'000F'	N/A	Invalid no. of blocks/files to space over or number of tape marks to write	Insert blk/file/ tape mark numbers, reissue REQIO, and issue a REQIO continue
X'E087'	X'0015'	N/A	Reserved fields in RD not zero. Note that no processing on the REQIO has occurred and	Correct the RD, reissue REQIO and issue a REQIO continue.

Table 1: 3410/3411 Error Summary Values

Feedback Record Error Summary	Dev Dep Code	Hardware Error Codes	Meaning	Recovery Action
			the RD number field in the FBR will con- tain zero.	

Note 1: If the hardware error code field contains X'0000', a previous feedback record for this device or another of the devices on this subsystem has been reported which contained the hardware error code for the problem encountered.

Note 2: This error only occurs for Load/Dump operations so the L/D indicator '0400'X is 'or'ed in which causes E410 instead of E010.

Table 2: 3410/3411 Errors by RD Commands

RD Commands (see Section 4.5.6.1)															
'02'X	-	read block													
'01'X	-	write block													
'12'X	-	read block backwards													
'14'X	-	forward space block													
'1C'X	-	backward space block													
'24'X	-	forward space file													
'2C'X	-	backward space file													
'34'X	-	rewind - delayed													
'35'X	-	rewind - immediate													
'B4'X	-	rewind and unload													
'54'X	-	write tape mark													
'4C'X	-	tape clear													
'0A'X	-	check tape													
Feedback	COMMAND														
Error Summary	02	01	12	14	1C	24	2C	34	35	B4	54	4C	0A		
C016		X		X	X	X									
C017			X									X			
C043		X	X	X											
C044		X	X	X											
C084		X	X	X											
E0100003		X	X	X									X		
E0100006			X									X	X		
E0100007		X		X	X		X								
E0100012		X	X	X	X	X	X	X	X	X	X	X	X		
E0100014			X*									X	X		
E4100020		X													
E0140012		X	X	X	X	X	X	X				X		X	
E018000A				X		X		X							
E018000B		X		X											
E018000C													X		
E087000D		X	X	X											
E087000E		X	X	X											
E087000F					X	X	X	X				X			
All other errors														Any Command	

* This error will only be signaled for the 'write block' command if issued while the tape is at load point.

4.5.7 EVENTS AND EXCEPTION CODES

4.5.7.1 Events

The following events are signaled by TAPE device management. For a complete description of the following events, see Chapter 8 of this document.

• CD Contact Event (0004 04 01,02)

This event is signaled for the MSCP component when the VARY ON processing is completed for this CD. This processing is done synchronous to the execution of the MODIFY CD (vary on) instruction so only subtype 01 (successful

contact) is signaled. Subtype 02 (unsuccessful contact) is not signaled on behalf of tape controllers since the MODIFY CD will be terminated and an exception will be signaled instead. See Section 4.5.7.2 for exception cases.

• CD Failure Event (0004 05 01)

The CD failure event is signaled and an error log entry is made whenever the entire subsystem receives a nonrecoverable error. As part of the recovery action for this event, the CD should be varied off and then varied back on before attempting further operations. The variable data provided for this event is formatted as follows:

- Error Code (bytes 0-1)--contains a hardware error code which further defines the specific error encountered. For this event, only the hardware error codes which are listed in Table 1 of Section 4.5.6.2 (Feedback Record) under the error summary codes for I/O Error--'F0DF'X and for subsystem failure--'E010 0001'X will be provided here (approximately 41 codes).
- Time stamp (bytes 2-9)--contains the time stamp of the corresponding error log message.
- OU number (bytes 10-11)--'0015'X

• LUD Contact Event (000B 06 01,02)

This event is signaled when the LUD vary on processing is completed by the MSCP. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details. Subtype 01 is signaled upon successful contact, however, subtype 02 (unsuccessful contact) is never signaled for Tape devices. In these cases, the MODIFY LUD (VARY ON) instruction signals an exception instead. This exception case can occur for the same reasons which the CD failure event is signaled.

• LUD Failure Event (000B 08 01)

The device failure event will be signaled and an error log entry is made whenever a tape drive has an uncorrectable problem (ie, where the recovery action is to call the CE). As part of the recovery action for this event, the LUD should be varied off and then varied back on before attempting further operations. The variable data provided for this event is formatted as follows:

- Error Code (bytes 0-1)--contains a hardware error code which further defines the specific error encountered. For this event, only the hardware error codes which are listed in Table 1 of Section 4.5.6.2 (Feedback Record) under the error summary code for Tape Drive Failure--'E010 0002'X--will be provided here (approximately 12 codes).

- Time stamp (bytes 2-9)--contains the time stamp of the corresponding error log message.

- OU number (bytes 10-11)--'0015'X

• REQIO Complete Event (000B 09 01)

The REQIO complete event will be signaled if the user requests it. See REQIO for details.

• Response Queue Destroyed Event (000B 0A 01)

The response queue destroyed event is signaled if the user truncates or destroys the Request I/O Response Queue while the machine is processing REQIOs.

4.5.7.2 Exception Codes Signaled by Tape Support

4.5.7.2.1 MODIFY CD EXCEPTION CODES FOR RESOURCE NOT AVAILABLE

For the Tape Controller CD object, the S/S Resource Not Available Exception ('3404'X) is only raised by the MODIFY CD instruction for the following state change modifications:

<u>Comma</u>	<u>Generic</u>	<u>Specific-Code</u>
POWER ON	'2206'X	'0602'X Power failure occurred. The CE failure event has also been signaled.
POWER OFF	'2207'X	'0602'X Same as above.
VARY ON	'2202'X	'0001'X I/O Controller Failure. CD failure event has also been signaled.

4.5.7.2.2 MODIFY LUD EXCEPTION CODES FOR RESOURCE NOT AVAILABLE

For the Tape device LUD objects, the S/S Resource Not Available exception ('3404'X) is only raised by the MODIFY LUD instruction for the following state change modifications:

<u>Command</u>	<u>Generic</u>		<u>Specific-Code</u>
VARY ON	'2302'X	None	Exception not signaled for this case.
ACTIVATE SESSION	'2303'X	'C4C0'X	Invalid storage pool specification for a Load/Dump session.
RESUME SESSION	'2311'X	None	Not signaled.
SUSPEND SESSION	'2312'X	'1201'X	Suspend rejected due to indeterminate length outstanding I/O operations.
QUIESCE SESSION	'2313'X	'1302'X	Quiesce rejected due to terminating error condition.
		'1301'X	Quiesce rejected due to indeterminate length outstanding I/O operations.
DEVICE SPECIFIC AREA	'2300'X	None	Not signaled.

4.6 3203-5 PRINTER

The 3203-5 device is a 1200 LPM printer on the System/38.

4.6.1 PROGRAMMING CONSIDERATIONS

The basic object of control is the Logical Unit Description (LUD). All references to a device are made with respect to the LUD. The CREATE, MODIFY, and DESTROY LUD MI instructions establish and control the environment in which the 3203-5 operates. The REQIO MI instruction controls the device and causes it to print data.

Before REQIO operations can be accepted, several steps must have occurred.

1. A 3203-5 LUD must have been created through use of the CREATE LUD instruction.
2. The 3203-5 LUD must have been varied on through use of the MODLUD VARY ON instruction.
3. The 3203-5 LUD must have been made active through use of the MODLUD ACTIVATE instruction.

4.6.2 CREATE LOGICAL UNIT DESCRIPTION (CRTLUD)

The fields in the LUD template must be initialized as follows:

FIELD NAME	ENTRY
LUD Type:	'00'C
Device Type:	'3203'C
Model Number (can only be stand alone):	' 5'C
LUD OU#:	'0040'X
1st 3203 Printer	'0041'X
2nd 3203 Printer	'0100'X
Power Control:	binary zero
Session Information:	binary zero
Load/Dump Indicator:	'0000'X
Specific Characteristics Length:	'0000'X
Retry Value Length:	'0000'X
Error Threshold Length:	'0000'X
Device Specific Contents	
Device Specific Length:	501
Device Specific Modifiable Length:	501
<u>Device Specific Area (DSA)</u>	Char(501)
Byte 0 Control Flags	Char(1)
Bit 0-1 Reserved (binary zero)	Bit(3)
Bit 2 Write Control	Bit(1)
0 = No data translation	
1 = Translate the data	

Bits3-7 Reserved (binary zero)

Bit(4)

Byte(1) Lines per inch

Char(1)

Byte(2) Lines per form

Char(1)

Bytes 3-4 Character Set Length

Bin(16)

Bytes 5-308 Universal Character Set Buffer (UCSB)

Char(304)

Bytes 5-244 Train Image

Char(240)

Bytes 245-308 Dualing & Uncomparable Character Table (DUCT)

Char(64)

Bytes 309-500 Translate Table

Char(192)

The device specific parameters may or may not be supplied in the DSA area of a create template. If they are not supplied at create time, the create template must still contain the 501-byte area and this area should be set to zero. The LUD will be created to contain whatever is in the template, without validating any of the parameters. These parameters are not reflected at the device until a MODLUD Modify DSA command is received. The default parameters contained in the printer will be used up to that time. These parameters are not used until after the LUD is in the active session state and processing a REQIO message. See the next section for details on how the device specific parameters are used.

The character set length is the number of unique characters in the train. Valid values are specified in the Pacific Hardware Specifications, Volume IV-B, Section 6. A length of 240 means that the entire train image has been supplied. If the length is less than 240, the specified portion of the train will be repeated to complete the train image.

The Universal Character Set Buffer (UCSB) is made up of the train image and the DUCT. The train image is the characters on the print train. If no train image is loaded, the default is used. See Pacific Hardware Specifications, Volume IV-B, Section 6, for definition of the default and other valid train images. The Dualing and Uncomparable Character Table (DUCT) specifies between 1 and 4 special characters that, although unprintable due to the train being used, are to be printed as a character on the train, eg, 'AN' train without dualing treats "=", "", "(", and ")" as unprintable characters but with dualing, they may be printed as a different special character. This area is also used for detecting unprintable characters. If the train image and the DUCT do not match, results will be unpredictable.

The translate table specifies how each character of print data should be printed. By properly specifying the translate table, characters that would have been treated as unprintable may be printed as some other character that is on the train (for example, lowercase letters may be translated to uppercase for trains lacking lowercase).

4.6.3 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

The following is a list of functions the 3203 supports through the MODLUD instruction:

POWER ON
 POWER OFF
 VARY ON
 VARY OFF
 ACTIVATE
 DEACTIVATE
 MODIFY DEVICE SPECIFIC AREA
 QUIESCE
 RESET
 RESUME (activate after suspend, quiesce or reset)
 SUSPEND

Refer to the Modify LUD instruction for the meaning of each function.

4.6.3.1 LUD Device Specific Area

The device specific area contains the information that is passed to the printer attachment to control the line spacing, form size, UCSB (train image and DUCT), and translate table used by the printer. This area may be altered via MODLUD at any time. Changing any portion of the DSA causes all DSA parameters to be written to the printer. Every time the form length or LPI is redefined, the line counter is set to top of form, so CHANGE DSA should not be issued in the middle of a form without appropriate operator instruction. It should be noted that any changes to the device specific area are reflected in the machine's processing of the next REQIO received.

The control flags field controls the translate mode in the machine. If translate data is specified, the data is translated based on the translate table prior to printing.

For the 3203-5, the lines per inch must be either 6 or 8. The lines per form setting must be greater than or equal to 2 and less than or equal to 254.

If the DSA parameters supplied for a MODLUD (DSA) command are invalid, a template value invalid exception may be signaled if the IOM has diagnosed the error or a terminating error feedback record ('E010000D3205'X') will be signaled for the next request I/O instruction if the device detects the error.

4.6.4 REQUEST I/O INSTRUCTION (REQIO)

The Request I/O instruction is used to send I/O requests to the device.

The Source Sink Request Area (SSR) for a REQIO to the 3203 contains the following values:

S/S Object System pointer to LUD

Response Queue	System pointer to response queue
S/S Data Area	Space Pointer to SSD
Optional Pointer	Reserved (binary zero)
Request Priority	See Vol III S/S REQIO
Request ID	See Vol III S/S REQIO
Function Field	'80'X
Control Field	'N' or 'C'
Key Length	See Vol III S/S REQIO
Key OFFSET	Bin(2)
RD COUNT	1 (or 0 for REQIO Continue)
RD OFFSET	Bin(2)

The 3203 supports only one RD per REQIO. The RD offset field indicates the offset from the start of the SSR to the 16-byte RD. The S/S Data Area (SSD) contains the data to be printed.

The format of the RD is as follows:

Byte 0	Command	Char(1)
	'41'X=Print SCS Data	
	'42'X=Continue Printing After Error	
Bytes 1-3	Command Modifiers	Char(3)
Bytes 4-15	Reserved (binary zero)	Char(12)

SCS Print ('41'X)

The SCS print command causes a block of print data to be printed. This block could be entirely SCS NO-OPs in which case the printer would not do anything.

Continue Printing After Error ('42'X)

A command of '42'X is used for error recovery. When received, printing will continue as if the previous error had not occurred. This command is intended for use only after errors which allow an ignore response as listed in Final Pacific Hardware Functional Specification, Volume IV-B, section 6. If given after the other errors listed it will be accepted, but results are unpredictable. An invalid RD command error will be signaled if:

1. The preceding REQIO did not have one of the errors listed in Vol IV-B.

The command modifier field (bytes 1, 2, & 3 of the RD) for the SCS print command have the following format:

Byte 1		Char(1)
Bits 0-4	Reserved (binary zero)	Bit(6)
Bit 5	Force full completion	
	0 = Maximize throughput (Normal Mode)	
	1 = Return completion status only after all data printed	
Bit 6	Unprintable Character Detection	
	0 = Signal unprintable character detected error	
	1 = Do not signal to user	
Bit 7	Save Data	
	0 = Start printing at beginning of SSD	
	1 = Retain any data saved from previous SCS print and	

continue where left off
 Bytes 2-3 Data Block Group Count Bin(2)

The Force Full Completion bit controls the adapter's response time. To maintain rated throughput, the adaptor will terminate a print command while still printing the last bytes of the data block. Error recovery during normal printing should account for this situation if possible. Using this bit to force full completion will cause some minor throughput degradation.

The ignore unprintable characters bit indicates whether or not to signal an unprintable character detected error to the user. The save data bit should normally be on; the adaptor will determine if part or all of the previous data was used and continue printing where it left off. The condition of this bit may be the cause of two seemingly unrelated error conditions. If left 'off' consistently, the adapter may cause extra page ejects. If this bit is 'on' in the SSR issued after MODLUD Reset, the REQIO may be rejected with a feedback record of command reject ('E010000D3205'X). The Data Block Group Count field indicates the number of 8 byte blocks in the SSD. The last 8 byte block must be padded out to a full 8 bytes with blanks or NO-OPs. The maximum number of 8-byte blocks is 8K(8192).

The Continue Printing After Error ('42'X) will be treated as follows:

- The SSD pointer value is ignored.
- The Force Full completion bit is assumed to be the same as the previous REQIO.
- The Unprintable Character Detection bit is significant with the same function.
- The Save Data bit is ignored. Processing assumes it to be on ('1'B).
- The Data Block Group Count is ignored.

SCS Instream Commands

The SSD is doubleword aligned and is made up of a mixture of SCS commands and data to be printed. The S/38 printers use the instream command codes defined in document SNA-0091-04. These SCS command definitions are the same as the ones used by the 5211 and 3262 line printers, and the 5256 (PERMA) Matrix Printer.

All PERMA SCS instream commands used in printing that have a corresponding function on the 3203 are supported. Those commands that have no corresponding functions are NO-OP'ed. There are no additional SCS commands used only on the 3203.

No initializing is done with SCS commands on the 3203. If any initializing SCS commands are received (load image, set forms length, set translate table, etc), they are NO-OP'ed.

When printing on an SCS command, the data stream written to the printer contains two types of codes:

1. Print Characters - X'40' through X'FE'. This is data to be printed. It may require translation and may result in an unprintable

character. If a character is unprintable, it may or may not be posted as an I/O error, depending on the translate data loaded and the ignore unprintable character option.

2. SCS Commands - X'00' through X'3F' and X'FF'. These instream control characters determine the format of the printed output. Any codes below X'40' that are not recognized or a code of X'FF' will result in an 'INVALID SCS' error being posted.

For a detailed discussion of each command, refer to Pacific Hardware Function Specifications.

Any form boundary crossing should use a 'form feed' command. If this is not done, an error may not be posted. However, on error recovery, printing and forms may not be properly aligned. The last request of a print file should have a 'form feed' in the last byte of the SS data block to assure that all printer operations will complete before posting ending status. If this is not done, it is possible that an error could be posted to the wrong print file.

4.6.4.1 Feedback Record (FBR) and Error Recovery Procedure

The format of the feedback record is as follows:

Bytes 0-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 23-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instructions for descriptions of the Request Address and Request ID fields.

The Error Summary field defines the status of the REQIO as generically defined in the REQIO instruction description. The specific values possible for the 3203 are itemized in Table 1 which follows.

The RD Number is the index of the last RD processed or the RD in error if an error is indicated. For the 3203, the RD number will always be one.

The RIU Segment Count is the number of forms completed by the printer until an error occurred. If no error occurred, this field is undefined.

The Device Dependent Area is all binary zero unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction. If the device dependent data is present the fields have the following definitions.

The device dependent error code is a further categorization of the hardware error codes, as shown in table 1.

The hardware error code is the error code logged in the system error log and indicates the specific hardware error encountered. The possible values are shown in table 1 and

further information is present in Pacific Hardware Functional Specifications.

The time stamp and OU# are the same values present in the hardware error log entry and are used to correlate the FBR and the error log entry for maintenance purposes.

Table 1. 3203 Error Summary Values

Error Summary	Dev Dep Error Code	Hdw Error Code	Meaning	Recovery
X'0000'	N/A	N/A	Normal Completion	N/A
X'0008'	N/A	N/A	Request I/O continue response	N/A
X'C009'	N/A	N/A	Partially processed request terminated due to reset session	Activate must be issued to restart processing or a deactivate must be issued to terminate the session.
X'C00A'	N/A	N/A	Unprocessed request due to reset session	Activate must be issued to restart processing or a deactivate must be issued to terminate the session.
X'C00B'	N/A	N/A	IOM Partial Damage	The LUD must be varied off to clear this condition. A partial damage event has also been signaled.
X'E041'	1001	N/A	SSD destroyed	Provide a correct SSD, perform any higher level recovery for data which may have been lost, then reissue REQIO, and issue a REQIO-continue.
	1002	N/A	SSD truncated or suspended	
	1003	N/A	SSD damaged	
X'C043'	N/A	N/A	Invalid SSD boundary alignment	Correct boundary alignment, re-issue REQIO, issue REQIO continue.
X'C044'	N/A	N/A	SSD too small	Correct SSD, perform any higher level recovery for data which may have been lost, then re-issue REQIO, issue REQIO continue.
X'C084'	N/A	N/A	Invalid SSD pointer	Replace SSD pointer with valid pointer, re-issue REQIO, issue REQIO continue.
X'C085'	N/A	N/A	Invalid function field	Correct function field, re-issue REQIO, issue REQIO continue.
X'C086'	N/A	N/A	Invalid RD Count	Remove extra RDs, re-issue REQIO, issue REQIO continue.
X'E010'	X'0002'	X'4450'	Invalid SCS command	Check SCS codes, correct command in error, and reprint form. A REQIO continue must be issued to resume processing.
X'E010'	X'0003'	X'5437'	Forms jam	Correct the forms jam and reprint form or forms. A REQIO continue must be issued to resume processing.
X'E010'	X'0005'	N/A	OU task failure	MODLUD reset, deactivate vary off required to clear this condition. LUD failure event has also been signaled.
X'E010'	X'0006'	X'7104'	Unprintable character detected	Line has been printed with blank substitution. If blank substitution acceptable, reissue failing REQIO with 'continue printing after error' command and issue REQIO continue. If not, correct print data, translate table, or train image. Issue REQIO continue and re-print the file.
X'E010'	X'0009'	N/A	Interlock open	Correct situation, ready printer, issue REQIO continue and re-issue failing REQIO message.
X'E010'	X'000C'		Printer adapter	Hardware failure. Reprint form. A REQIO continue is

Table 1. 3203 Error Summary Values

Error Summary	Dev Dep Error Code	Hdw Error Code	Meaning	Recovery
			or hardware failure	needed to resume processing. If error persists, call CE.
		X'4020'	Post event--CSA parity	
		X'4040'	Post Event--IOC parity	
		X'4080'	Post event--DBI parity	
		X'7004'	Interface check	
		X'7006'	Incorrect length	
		X'7014'	Command reject (3203-5)	
		X'7101'	Equip ck misc	
		X'7102'	Equip ck--coil protect or hammer fire	
		X'7103'	Equip ck--controller	
		X'7106'	Data ck--line position ck	
		X'7108'	Buffer parity ck PLB	
		X'7109'	Buffer parity ck-UCSB	
		X'7122'	Bus out ck	
X'E010'	X'000D'		System error	System failure. Reprint form. A REQIO continue must be issued to resume processing. If error persists, seek software assistance.
		X'3203'	Channel error	
		X'3205'	Command reject (IOC)	
		X'4034'	Invalid disconnect	
		X'4038'	Invalid OU det by adapter	
		X'4452'	FOB busy det by adapter (invalid) channel sequence)	
		X'7010'	1.6ms timer failure (diag only)	
		X'9000'	Op program error	
X'E010'	X'0019'		Offline	Power up, attach, or switch printer online and make ready. Issue REQIO continue and re-issue failing REQIO message.
X'E010'	X'001A'		Out of forms	Install forms. A REQIO continue is needed to resume processing.
X'E010'	X'001B'	X'7030'	Stacker full or jam	Correct the condition and continue. A REQIO continue must be issued to resume processing.
X'E010'	X'001C'	X'7120'	Load check--invalid forms control buffer	Ready printer and retry MODLUD DSA change command A REQIO continue must be issued to resume processing. If error recurs, call CE.
		X'7121'	Load check--invalid train image	
X'E087'	X'0007'	N/A	Invalid RD cmd	Correct RD command in error, reissue REQIO, and issue

Table 1. 3203 Error Summary Values

Error Summary	Dev Dep Error Code	Hdw Error Code	Meaning	Recovery
			detected or command '42'X received when not valid	a REQIO continue.
X'E087'	X'0008'	N/A	Zero data block count detected or data block count > 8192	Fix data block count, reissue REQIO and issue a REQIO continue.
X'E087'	X'0017'	N/A	Reserved fields violated	Zero reserved fields, reissue REQIO and issue a REQIO continue.
X'F075'	N/A		Error during error recovery or vary on	Hardware failure. Cancel print file and call CE. A LUD failure event has been signaled.
		X'4101'	FOB time out	
		X'4102'	Invalid adapter response	
		X'4103'	Startup command failed	
		X'4110'	Read sense or adapter reset failure	
		X'4111'	Error on read IOC sense, read line total, or read error log	

4.6.5 EVENTS AND EXCEPTION CODES

4.6.5.1 Events

The following events are signaled by the 3203 in addition to the events identified generically in the REQIO instruction in the MI Architecture. For a complete description of these events, see Chapter 8 of this document.

- LUD Contact Event (000B 06 01)

This event is signaled by the MSCP when the VARY ON processing is completed for this device. Only subtype 01 (successful contact) is signaled. Subtype 02 (unsuccessful contact) is never signaled since the MSCP processing is synchronous to the MODIFY LUD (VARY ON) and an exception will be signaled instead.

- LUD Failure Event (000B 08 01)

This event is signaled and an error log entry is made whenever the printer has an uncorrectable problem; ie, where the recovery action is to call the CE. As part of the recovery action for this event, the LUD should be varied off before attempting further operations.

LUD failure will be signaled for the following return codes:

```
X'E010'      X'0005'
X'F075'      X'0000'
```

The 14-byte variable data returned with this event is formatted as follows:

Bytes 0-1 - Status--hardware error code which was included in the error log message. See Table 1 of Section 4.6.4.1 (Feedback Records) for a list of these error codes and the appropriate recovery actions.

Bytes 2-9 Timestamp--Contains the time stamp of the corresponding error log message.

Bytes 10-11 OU Number--'0040'X or '0041'X.

Bytes 12-13 Optional Data--Binary zero.

- Operator Intervention Required Event (000B 07 01)

This event is signaled when the device goes to a state that requires operator action but is not in error mode.

The 14-byte variable data returned with this event is formatted as follows:

Bytes 0-1 - Status--hardware error code which was included in the error log message if there was a corresponding error log message, otherwise zero.

Bytes 2-9 Timestamp--Contains the time stamp of the corresponding error log message, otherwise zero.

Bytes 10-11 OU Number--'0040'X or '0041'X.

Bytes 12-13 Optional Data--see following table.

<u>Condition</u>	<u>Indication</u>	<u>Description</u>
Byte 12 bit(0)	READY OFF	Printer command was issued and the printer was not ready. Printer is stopped and not ready as a result of a normal stop condition.

The remaining bits of byte 12 are zero. Byte 13 is zero.

Recovery Procedure

Check display lights on 3203 and correct problem (if one exists)
Press START

- REQIO Complete Event (000B 09 01)

This event will be signaled when the REQIO is done if the user requests it. See REQIO for details.

- REQIO Response Queue Destroyed Event (000B 0A 01)

This event will be signaled if the user truncates or destroys the Request I/O Response Queue while the machine is processing REQIOs.

4.6.5.2 Exception Codes

The following table provides a summary of the cases where the S/S Resource Not Available exception ('3404'X) will be signaled when a MODIFY LUD instruction is executed for this printer device:

EXCEPTION DATA

<u>Command</u>	<u>Generic</u>	<u>Specific</u>	<u>Code</u>
POWER ON	'2306'X	'0602'X	I/O device power failure. Device is controlled by the power controller. LUD failure event has been signaled.
POWER OFF	'2307'X	'0602'X	I/O device power failure. Device is controlled by the power controller. LUD failure event has been signaled.
SUSPEND SESSION	'2312'X	'1203'X	Suspend rejected due to operator intervention condition existing.
QUIESCE SESSION	'2313'X	'1302'X	Quiesce failure due to terminating error conditions existing.
	'2313'X	'1303'X	Quiesce failure due to operator intervention condition existing.

4.7 RESERVED

4.8 3430 (PIMA) MAGNETIC TAPE

4.8.1 3430 TAPE DEVICE IOM

The 3430 tape device may be used for either load/dump or data interchange magnetic tape operations. Data compression/decompression is only supported for the Load/Dump cases.

4.8.1.1 Programming Considerations

Each 3430 tape drive requires a LUD (type 10) object to be created for its support. A CD (type 00) object must be created for the tape subsystem. These system objects must be created and initialized via the CRTLUD and CRTCD instructions. There must be enough space reserved in each LUD for the Device Specific Area needed by the machine. The device specific parameters control the processing performed during an active session.

A REQIO must be preceded by the functions available in MODCD and MODLUD to power on, Vary On, and activate a logical session for the tape CD and LUD. A REQIO can then cause data to be transferred to or from the tape media.

4.8.1.2 Create Controller Description (CRTCD)

The following fields in the CREATE CD template must be initialized for the 3430 tape Control Unit Description. All fields must be set to hex zero unless otherwise indicated below:

```

CD Type:                '00'C
Unit Type:               '3430'C *
Model Number:           'A01'C
Physical Address
(CD OU#):               '0052'X
Power Control:          '0100'X
Station Control
Information:             All binary zero
Selected Mode Data:     All binary zero
Activate Physical Unit
Information:             All binary zero
Dial Digits:            All binary zero
Specific Characteristic
Length:                  '0008'X
XID Information Length   '0000'X
Unit Specific Contents
Length:                  '0000'X
Specific Characteristics Parameters

```

```

Bytes 0-1 Feature Installation Char(2)
      '0000'X = None installed
      '0001'X = HDC Feature for
                3430 installed
                on System/38
Bytes 2-7 Reserved (binary zero) Char(6)

```

4.8.1.3 Modify Controller Description (MODCD)

The following is a list of functions the 3430 tape subsystem supports through the MODCD instruction.

```

RESET DIAGNOSTIC MODE
POWER ON
VARY ON
VARY OFF
POWER OFF
SET DIAGNOSTIC MODE

```

Refer to the Modify CD Instruction for the meaning and use of each function.

Modify CD (Vary Off) - Error Recovery Cases

When processing a MODCD (Vary Off) after error recovery conditions have occurred where the MODLUD (Vary Off) processing may not have completed normally, the MODCD will issue an automatic Rewind/Unload to all the tape devices to prevent inadvertently powering down the tape device while a tape is still loaded which could cause physical damage to the tape(s).

Modify CD - Reset Diagnostic Mode

For 3430 tape controller, a MODCD Reset Diagnostic Mode is used to return the Controller Description to Power On or Power Off state from Diagnostic state. In so doing, MODCD sends a "power status" request to the tape controller to determine its power status. If the tape controller is powered on, the Controller Description is set to Power On state; if it is powered off, the Controller Description is set to Power Off state. If the power status request failed to determine its status, MODCD attempts to power off the controller; if this is successful, the Controller Description is set to Power Off state; if not, it is left in Diagnostic state.

Inasmuch as a successful Reset Diagnostic mode may leave the Controller Description in either Power On or Power Off state, this can cause some difficulty in using programs which might assume that it will be in Power Off state on completion of the Reset Diagnostic mode. To minimize this difficulty, if the using program specifies a Reset Diagnostic mode and Power On request on one MODCD instruction, the MODCD code will honor the combination as successful if the Reset Diagnostic Mode succeeded and set the controller to Power On state - in this particular case, the Power On part of the request is honored as if executed, and no Object state Invalid exception is raised.

4.8.1.4 Create Logical Unit Description (CRTLUD)

The following fields in the CREATE LUD template must be initialized for the 3430 tape Logical Unit Description. All fields must be set to hex zero unless otherwise indicated below:

LUD Type: '10'C
 Device Type: '3430'C *
 Model Number: 'A01'C for first drive
 'B01'C for second
 through fourth
 drives

Forward Object
 Pointer: Pointer to 3430 tape CD
 Physical Address:
 LU Address: '0000'X, for the first drive
 which must be a model
 A01.
 '0001'X, '0002'X or '0003'X -
 for the second through
 fourth drives which
 must be model B01

CD OU#: '0052'X
 Power Control: All binary zero
 Session Definition
 Data: All binary zero
 Load/Dump Definition
 Data:
 L/D Device Field: '00'X Not used as a L/D
 Dev
 '01'X Load/Dump device
 - noninterruptible
 - nonexchangeable
 '21'X Load/Dump device
 - exchangeable
 L/D Mode Field: '00'X Normal Mode
 '01'X Load Mode-Primary
 '02'X Dump Mode-Primary

Remaining L/D field
 (See following sect
 MODLUD L/D Indicato
 Specific
 Characteristics
 Length: '0000'X
 Retry Value Length: '000C'X
 Tape Retry Values: See below
 Error Threshold
 Length: '0010'X
 Tape Error Threshold
 Values: See below
 Device Specific Area:
 Allocated Length: 90
 Modifiable Length: 86
 Parameters: See below

Tape Retry Values:

Error-Type	Error Description	Retry Value
X'0001'	I/O Error, Unit Check, Data Check on Read Cmd (Reads per Retry - 5 reads forward, 5 reads backward)	Value (10-20) Suggested - 10
X'0002'	I/O Error, Unit Check, Data Check on Write Cmd	Value (15-30) Suggested - 15

Tape Error Threshold Values:

Error Type	Error Description	Threshold Value
X'0001'	I/O Error, Unit Check, Data Check on Read Cmd	Value (1-10) Suggested - 5

X'0002' I/O Error, Unit Check, Value (1-64)
 Data Check on Write Cmd Suggested - 32

Device Specific Area Parameters:

Bytes 0-5	Active Session Flags (User specified)	Char(6)
Byte 0	Tape Encoding	Char(1)
Bit 0	0=EBCDIC tape 1=ASCII tape	
Bit 1	Unused	
Bits 2-7	Reserved (binary zero)	
Bytes 1-2	Reserved (binary zero) Note: These two reserved bytes are common reserved areas in 72MD, 3410 and 3430 LUD's.	Char(2)
Byte 3	Tape Density 'C3'X - 1600 BPI 'D3'X - 6250 BPI	Char(1)
Bytes 4-5	Load/Dump Block Counter Updated by the number of blocks transferred	Char(2)
Bytes 6-85	Volume Label	Char(80)
Bytes 86-89	Reserved (binary zero)	Char(4)

A Tape Density value other than 'C3'X (1600 BPI), will cause the Tape Density to default to 6250 BPI.

When loading or dumping objects under Load/Dump the maximum block size will be 31744 bytes.

The Device Specific Area may be modified through MODLUD and should be modified each time a different tape is mounted to properly identify that tape and its attributes. This is particularly important to ensure proper logging of volume SDRs. (This would not be necessary when writing to a non-label tape.)

4.8.1.5 Modify Logical Unit Description (MODLUD)

The following is a list of functions the 3430 tape device supports through the MODLUD instruction:

```

VARY ON
ACTIVATE
DEVICE SPECIFIC AREA
LOAD/DUMP INDICATOR
ERROR RETRY VALUES
ERROR THRESHOLD VALUES
SUSPEND
QUIESCE
RESET
RESUME (activate after suspend, quiesce or reset)
DEACTIVATE
VARY OFF
  
```

Refer to the Modify LUD instruction for the meaning and use of each function.

Modify LUD (Device Specific Area)

The LUD is created to contain whatever is in the create template without validating any of the Device Specific Area parameters. Tape density will not be reflected at the device until a MODLUD Modify DSA command or REQIO Check Tape command is received. Changes in tape density for write operations will not become effective until a write operation occurs when the tape is positioned at the beginning-of-tape (BOT) marker. The Device Specific Area of the LUD (that portion that is modifiable) may be altered at any time. It should be noted that, except for density, any changes to the Device Specific Area are immediately reflected in the drive's processing. For this reason, the area should only be altered before the processing of the tape media and not during processing.

The machine maintains a copy of the Load/Dump block counter. The value in the Device Specific Area is copied when the LUD is varied on and when there is a Device Specific Area change and is updated whenever a Load/Dump message is returned. This requires the user to initialize the counter and avoid making any Device Specific Area changes while a Load/Dump message is outstanding.

Modify LUD (Load/Dump Indicator)

Operating the 3430 tape devices for load/dump media operations is performed by modifying this field in the 3430 LUD. The allowable operations are controlled by whichever value was selected for the Load/Dump Device field at CREATE LUD time.

1	- L/D Device Field	'00'X	(Not used for L/D operations)
			No further operations for the L/D Indicator field are allowed.
2	- L/D Device Field	'01'X	L/D device - nonchangeable, noninterruptable
	- L/D Mode Field	'00'X	Normal Mode (data interchange)
		'01'X	Load Mode
		'02'X	Dump Mode
			All remaining fields within the L/D Indicator are unused.
3	- L/D Device Field	'21'X	L/D device - exchangeable
	- L/D Mode Field	'00'X	Normal Mode (Data interchange)
		'01'X	Load Mode - Primary device
		'02'X	Dump Mode - Primary device
		'21'X	Load Mode - Alternate device
		'22'X	Dump Mode - Alternate device
	- L/D Pending Field	'0000'X	Set to binary zero. Not used for exchange operations.
	- L/D Corresponding Primary Address	'0000'X	For L/D Modes: '00'X Normal '01'X Load Primary '02'X Dump Primary
	or	'0000'X	For L/D Modes:
		'0001'X	'21'X Load Alternate
		'0002'X	'22'X Dump Alternate
		'0003'X	In these cases, this field specifies the LUD address of the corresponding Primary device to exchange with.
	- L/D Exchange Field		This field is used only when operating in one of the Load/Dump Modes (not Normal). It is used to change or indicate which of the LUDs is currently allowed to process Load/Dump Request I/O

instructions.

For MATLUD:	'000000'X	This device is 'not current'
	'010000'X	This device is 'current'
For MODLUD:	'000000'X	No modification requested
	'010000'X	Modify this LUD to become
	'010001'X	'current' ('01'X) where the
	'010002'X	last current device is the
	'010003'X	LUD with LU address '0000'X, '0001'X, '0002'X or '0003'X (whichever is specified). The other LUD is modified to 'not current'.
Load/Dump Buffer Storage	Bin(2)	This field is used to specify the amount of buffer storage which L/D is allowed to extract from the user's process storage pool. This value is specified in units of minimum transfer size for the machine (512 bytes). Values can range from 64 to 512 (for buffer sizes from 32K bytes to 256K bytes).
- Load/Dump Process Priority	Char(1)	This field can be used to specify the relative priority at which the internal Load/Dump processes will run. A value of zero specifies the highest priority. This parameter allows the L/D to contend with other concurrent user processes in a manner where L/D has very little impact on other processes or conversely where L/D performance itself experiences very little impact.

NOTE: The above two parameters are defined as part of the interface at Release 5 level, however support of these functions will not be available until the follow-on L/D enhancements are incorporated.

Modify LUD (Error Retry Values)

This set of values specifies the number of retry passes which the machine should attempt in order to recover from that particular error type. For Data Check on Read commands each 'pass' will cause 5 forward and 5 backward read attempts so for the suggested retry value of 10, a total of 100 read attempts (50 forward and 50 backward) would be made. For Data Check on Write commands each 'pass' will cause a backspace, an erase gap and a re-write attempt, so for the suggested retry value of 15, a total of 15 write attempts would be made.

Increasing these retry values above the suggested values is a recovery technique which the user may attempt if he is encountering media errors due to marginal tapes.

Modify LUD (Error Threshold Values)

For the same two errors defined above, the user may control the frequency for which error log entries are made for these errors by changing the threshold value. For a threshold value of 'n', every nth occurrence of an original error is logged.

Increasing 'n' will reduce the amount of logging done, which is a proper action to undertake if these errors are occurring very frequently due to marginal media.

Modify LUD (Reset)

A Reset will cause the IOM to immediately terminate all processing to the specified device. All requests for that device will be returned as 'partially processed' or 'unprocessed'.

All hardware operations, except disconnected operations, will be halted. Tape motion for halted operations will end at the next hardware detected boundary (IBG, Tape Mark, BOT, EOT etc) depending on the command.

Disconnected operations (Rewind, Rewind/Unload, Data Security Erase) can not be halted by the IOM and will continue to their completion unless otherwise terminated by the user.

When a message is returned as 'partially processed due to Reset', the amount of work completed and tape position for that device is indeterminate. Error

conditions encountered by that device prior to the Reset may also be lost.

4.8.1.6 REQUEST I/O INSTRUCTION (REQIO)

The REQIO instruction is used to send I/O requests to the device. The formats defined in this section are for normal data interchange I/O operations only and do not include any of the Load/Dump operations. Refer to Section 6 for L/D Request I/O formats, including use of data compression/decompression.

The SSR for a REQIO to one of the tape drives contains the following values:

S/S Object	- Pointer to the corresponding tape LUD
Response Queue	- Pointer to response queue
S/S Data Area	- Space Pointer
Optional Pointer	- Reserved (binary zero)
Request Priority	- See Volume III, S/S REQIO
Request ID	- See Volume III, S/S REQIO
Function Field	- '80'X
Control Field	- 'N' or 'C'
Key Length	- Bin(2)
Key Offset	- Bin(2)
RD Count	- See below
RD Offset	- Bin(2)

At least 1 Request Descriptor (RD) must exist with each Normal REQIO or a template value invalid exception will be returned.

All label processing must be done by the user. The machine will not check for this. An example is the sequence of trailer labels which must be issued to the machine in accordance with the tape standards specification.

The Device Specific Area in the LUD must specify ASCII encoding when the tape is encoded (or is to be encoded) in ASCII. The machine will convert the data to/from ASCII from/to EBCDIC.

REQUEST DESCRIPTOR

The RD format is as follows:

Byte 0	Command	Char(1)
	'01'X - Write Block	
	'02'X - Read Block	
	'0A'X - Check Tape - Immediate	
	'0B'X - Check Tape - Delayed	
	'12'X - Read Block Backwards	
	'14'X - Space Block Forward	
	'1C'X - Space Block Backward	
	'24'X - Space File Forward	
	'2C'X - Space File Backward	
	'34'X - Rewind - Delayed	
	'35'X - Rewind - Immediate	
	'4C'X - Clear Tape	
	'54'X - Write Tape Mark	
	'B4'X - Rewind/Unload - Delayed	
	'B5'X - Rewind/Unload - Immediate	

Byte 1	* Control	Char(1)
Bit 0	0=Process RD 1=Do not process RD	
Bit 1	0=No wrong length records were detected 1=Wrong length record has been detected	
Bit 2	0=Return error if wrong length record detected 1=Do not return error for wrong length records	
Bit 3	0=Volume is not write protected 1=Volume is write protected	
Bits 4-7	Reserved (binary zero)	

Bytes 2-3	* Operations Performed	Bin(2)
-----------	------------------------	--------

Bytes 4-5	* Block Size Detected	Bin(2)
-----------	-----------------------	--------

Byte 6-7	Reserved (binary zero)	Bin(2)
----------	------------------------	--------

Byte 8	* Tape Density	Bin(1)
--------	----------------	--------

Byte 9	Operations to Perform	Bin(1)
--------	-----------------------	--------

Bytes 10-11	Block Size (18-32768 bytes)	Bin(2)
-------------	-----------------------------	--------

Bytes 12-13	Reserved (binary zero)	Bin(2)
-------------	------------------------	--------

Bytes 14-15	Reserved (binary zero)	Bin(2)
-------------	------------------------	--------

* Fields identified by an '*' are modified by the REQIO execution.

The Command field indicates the type of operation to be performed. The specific commands are described later.

The Control field specifies certain actions to be taken in processing the RD.

Bit 0 of the Control field indicates whether or not this RD is to be processed or not. A zero in this field means the RD is to be processed and a binary one means the RD should not be processed. This field will be set to a binary one by the machine when the RD is successfully completed. After normal completion, this field must be reset by the user before the RD can be reused. (Note: Processed Read/Write RD's will still be used in calculating the buffer address for following Read/Write RD's.)

Bit 1 of the Control field indicates whether or not a wrong length record has been encountered. This field will be set to a binary one by the Tape Subsystem whenever a wrong length record is encountered for this RD.

Bit 2 of the Control field indicates the action to be taken for a wrong length record encountered during a read operation (when specifying only one data block per RD). If this bit is set to a binary zero and a wrong length record is encountered, processing will stop and an error will be returned in the feedback record. If this bit is set to a binary one and a wrong length record is encountered, processing will continue with the next RD. If the Operations to Perform field specifies more than one

operation, this bit will be ignored and an error will be returned for any wrong length records.

Bit 3 of the Control field indicates whether or not the volume currently mounted is write protected. A binary 1 in this field indicates that the volume is write protected. This bit is set only for the Check Tape - Immediate command and only if the device is ready.

The Operations Performed field indicates the number of operations which have completed successfully for this RD. This field should be set, by the user, to zero when the REQIO is first issued. The machine will increment this field each time a Read, Write or Space operation completes successfully. This field in conjunction with the Control field of previously processed RDs can be used to reissue a REQIO after an error. When reissuing a REQIO after an error, the user should not change this field if the original number of operations specified are desired.

Note: When a wrong length record is encountered, this field will not include the block just read even if Bit 2 of RD Byte 1 is on.

The Block Size Detected field indicates the block size read if the block size is less than the block size specified. If the block size read is greater than the block size specified, the Block Size Detected will be zero. This field is set by the tape subsystem only when a wrong length record is detected.

The Tape Density field is filled in only for the Check Tape - Immediate command when the device is ready and will indicate the density of the tape using the same format (hex code) as in the LUD.

The Operations to Perform field indicates the number of Read, Write or Space operations to be performed.

The Block Size field indicates the size of the block or blocks to read or write. This must be greater than or equal to 18 and less than or equal to 32,768.

The RD Commands

The following are the commands supported in the REQIO instruction:

'01'X - Write Block

With this command, the user may specify from 1 to 255 blocks to write. The remaining portion of the user's source/sink data area must be equal to or greater than the amount of data to be written by this RD. The required size of the data area is calculated by rounding the block size up to a multiple of eight and then multiplying by the block count. The data area must be double word aligned for block sizes up to 32256 and page aligned for block sizes greater than 32256. Page alignment is recommended even for block sizes less than 32256 to obtain increased performance.

Data transfers always begin on an eight byte boundary. Therefore, when writing a block of data that is not a multiple of eight bytes, the data bytes greater than the block size but less than the next multiple of eight are ignored. Transfer for the next block will begin at the next eight byte boundary.

If the data is to be converted from EBCDIC to ASCII format, the data is copied from the SSD area to an internal buffer, then converted in the internal buffer.

If the end-of-tape marker is sensed when attempting to write a block, the block will be written and the user notified that this occurred. Once the end-of-tape has been sensed, subsequent Write commands which are issued with the tape positioned past the end-of-tape marker may continue to have this error indicated and only one block will be written per request. If this happens, end-of-tape may only be indicated once. Subsequent write operations may cause the end of the tape to run off the end of the reel.

If a Write command results in an error and the machine, after retrying the command, successfully completes the operation, the machine will continue processing. If the error is unrecoverable, the operation stops and an error is indicated.

The Operations Performed field in the RD will indicate the number of blocks successfully written for this RD.

Tape density and tape encoding must be specified in the LUD to ensure proper operation.

'02'X - Read Block

With this command, the user may specify from 1 to 255 blocks to read. The remaining portion of the user's source/sink data area must be equal to or greater than the amount of data to be read by this RD. The required size of the data area is calculated by rounding the block size up to a multiple of eight and then multiplying by the block count. The data area must be double word aligned for block sizes up to 32256 and page aligned for block sizes greater than 32256. Page alignment is recommended even for block sizes less than 32256 to obtain increased performance.

When the block size of a data block is not a multiple of eight, the data will be transferred into the user's buffer and padded with hexadecimal zeros up to the next eight byte boundary. Transfer of the next block will begin at this eight byte boundary.

Whenever the block size detected is different than that specified in the RD, the Block Size Detected field will be set by the machine.

When the block size detected is smaller than specified, the Block Size Detected field in the RD will be set to the actual size of the block read and the unused area of the user's buffer will be indeterminate. When the block size detected is larger than specified, the Block Size Detected field in the RD will be set to zero and the block will be truncated to the size specified in the RD.

The user may indicate that no error is to be returned for a wrong length record by setting Bit 1 of the RD Control field to a binary one and specifying only 1 block of data be read per RD. An error will be returned when a wrong length record is detected if Bit 1 of the RD Control field is set to zero or the Operations to Perform field is not equal to one.

If a tape mark is encountered, an error will be returned and the position of the tape will be beyond the tape mark. The end-of-tape marker is not recognized by this command.

If in retrying a read of a bad block, the read operation completes successfully, the machine will continue processing. If the error cannot be corrected, the operation stops, and the error is returned.

The Operations Performed field in the RD will indicate the number of blocks successfully read for this RD.

Tape density need not be specified in the LUD for reading. Tape encoding must be specified to ensure proper operation.

'0A'X - Check Tape Immediate
'0B'X - Check Tape Delayed

These commands check on the status of the specified tape drive. The following table summarizes the tape drive status which may be indicated in the feedback record generated by these commands. If the immediate response form of the command is used, status will be determined and reported in the feedback record immediately according to the following table. If the delayed response form is used, the status will be determined and reported as soon as the tape unit becomes 'not busy' (I.E. when there is no tape movement).

FEEDBACK ERROR SUMMARY

'0A'X-

CONDITION	Immediate	'0B'X-Delayed
- Tape Drive Ready and at BOT	0000 (Normal)	0000 (Normal)
- Tape Drive Ready but not at BOT	E018 000C	E018 000C
- Tape Drive not Ready but at BOT	E014 0008	E014 0008
- Tape Drive not Ready	E014 0013	E014 0013
- Tape Drive Busy	E014 0012	(Response is delayed until drive not busy)

The 'Check Tape' command will cause the device tape density to be set to the tape density indicated in the Device Specific Area of the LUD. This density will not become effective for write operations until

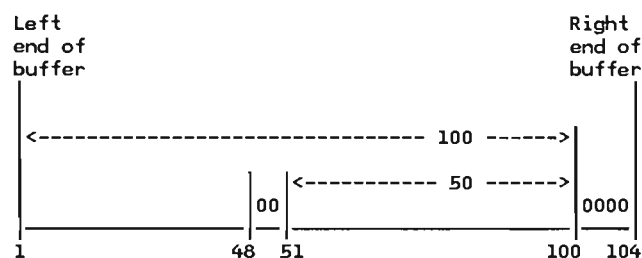
a write operation occurs when the tape is positioned at BOT.

The Check Tape - Immediate command will set RD Byte 1 Bit 3 to indicate the write protect status of the tape and RD Byte 8 to indicate the current device density. NOTE: A tape density of 1600 BPI will always be indicated when the tape is at BOT.

'12'X - Read Block Backward

This command is similar to the Read Block command except that the data is read from the tape while the tape is moving backward toward beginning-of-tape (BOT).

The user supplies the address of the 'left' end of the buffer, as with the Read Block command, but the data blocks are transferred into the user's buffer beginning at its calculated 'right' end, as shown in the following illustration:



To read a data block with a block size of 100 requires 104 bytes of the user's buffer (100 rounded up to a multiple of 8). Bytes 101 to 104 are padded with hex zeros and the data block is transferred into the user's buffer from right to left beginning at byte 100.

When the block size detected is smaller than specified, the contents of the unused buffer area will be as follows: If the data did not end on an 8 byte boundary from the right end of the buffer, that portion up to the next 8 byte boundary will be set to hex zeros. The remainder of the buffer will be unchanged.

For example, if a block size of 100 is specified and the block size detected is 50, bytes 51 through 100 will contain the data block, bytes 49 and 50 will be set to zeros, and bytes 1 through 48 will be unchanged.

When the block size detected is larger than the block size specified, the 'left' end of the block will be truncated rather than the 'right' end as with the Read Block command.

The order in which the data blocks are transferred into the user's buffer depends on the number of blocks read for each RD. For example, if three contiguous blocks (A,B,C) are read from tape with a single RD, they are transferred into the user's buffer in the same contiguous order (A,B,C) as they are on the tape. But if those same blocks are read one at a time using three RD's, they are transferred into the user's buffer in three operations and

reside in the user's buffer in the opposite order (C,B,A).

If the beginning-of-tape marker is encountered by this command, an error will be returned and the position of the tape will be at BOT.

'14'X - Space Block Forward
'1C'X - Space Block Backward
'24'X - Space File Forward
'2C'X - Space File Backward

With this group of commands, the user may position the tape to a particular block or file relative to the current tape position. From 1 to 255 blocks or files can be spaced. In spacing forward or backward, the tape will stop beyond the block or file requested in the direction of travel. The number of blocks or files spaced will be returned in the Operations Performed field of the RD.

The Space Block Forward command will move the tape forward to the next interblock gap (IBG) the number of times specified in the RD. If a tape mark is encountered by this command, an error will be returned and the position of the tape will be beyond (after) the tape mark. The end-of-tape marker is not recognized by this command.

The Space Block Backward command will move the tape backward to the previous IBG the number of times specified in the RD. If a tape mark is encountered by this command, an error will be returned and the position of the tape will be beyond (in front of) the tape mark. If the beginning-of-tape marker is encountered by this command, an error will be returned and the position of the tape will be at BOT.

The Space File Forward command will move the tape forward to the IBG beyond (after) the next tape mark the number of times specified in the RD. The end-of-tape marker is not recognized by this command.

The Space File Backward command will move the tape backward to the IBG beyond (in front of) the previous tape mark the number of times specified in the RD. If the beginning-of-tape marker is encountered, an error will be returned and the position of the tape will be at BOT.

'34'X - Rewind Immediate
'35'X - Rewind Delayed
'B4'X - Rewind/Unload Immediate
'B5'X - Rewind/Unload Delayed

With these commands, the tape can be rewound or rewound and unloaded. These commands position the tape at beginning-of-tape or put it in a state to be dismounted.

If the RD specifies a delayed response command, or if the RD specifies an immediate response command and is followed by successive RDs, the operation will be completed before the REQIO is returned.

If the RD specifies an immediate response command and is the last RD of the SSR, the request will be

returned to the user when the operation begins. If a serious error (E010 0002) is then encountered for this operation, an error will be returned in the next request received by the IOM.

'4C'X - Clear Tape

With this command, the user may erase data from the tape. If the tape is before the end-of-tape marker, this command will cause the tape to be erased from its current location to the end-of-tape marker. If the tape is beyond the end-of-tape marker, this command will cause 3.6 inches of tape to be erased if the tape density is 1600 BPI or 3.45 inches if the tape density is 6250 BPI. If the end of the tape runs off the end of the reel while erasing beyond the end-of-tape marker, an error will be returned.

'54'X - Write Tape Mark

With this command, the user may write from 1 to 255 tape marks. These tape marks are used to indicate the end of a tape file.

DATA COMPRESSION

The 3430 IOM will support RD indicators for data compression as defined within the Load/Dump Request I/O operations. The data compression will be accomplished by use of the SNA compression algorithm using string counts of 2-63 prime and 3-63 non prime characters and using prime compression character X'40'. See chapter 6.0 Load/Dump for details.

FEEDBACK RECORD

The feedback record (FBR) is the vehicle for signaling to the program that the functions requested in a REQIO instruction have completed, and whether they completed successfully or not.

The format of the feedback record is as follows:

Bytes 0-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	Reserved	Char(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Time Stamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-39	Fault Symptom Code (FSC)	Char(2)
Bytes 40-63	Reserved	Char(24)

See the REQIO instruction for descriptions of the Request Address and Request ID fields.

The Error Summary field defines the status of the REQIO as generically defined in the REQIO instruction description. The specific values possible for the tape subsystem are itemized in Table 1 which follows. A user running in the Save/Restore environment may expect to find these codes altered by Load/Dump before being returned in the REQIO and should refer to documentation on Load/Dump for error codes issued by that component.

The RD Number is the index of the last RD processed or the RD in error if an error is indicated.

The Device Dependent Area is all binary zero unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction.) If the device dependent data is present, the fields have the following definitions.

The Device Dependent Error Code is a further categorization of the hardware error codes, as shown in Table 1.

The Hardware Error Code indicates the specific hardware error encountered. The possible values are shown in Table 1.

The Time Stamp indicates the time that the error occurred.

The OU# is the number assigned to the Tape Subsystem.

Table 1: 3430 Error Summary Values

The Fault Symptom Code (FSC) is defined by the hardware and in conjunction with the device OU number to define the System Reference Code (SRC) which is used to identify to field support personnel a field replaceable unit (FRU) that is failing and causing the machine to experience hardware problems. (See Table 1 for possible values).

The Hardware Error Code, Time Stamp, OU# and Fault Symptom Code are contained in the hardware error log record and are also provided as event related data when CD and LUD failure events are signaled. They are used to correlate the error log entry, event and FBR for maintenance purposes.

Table 1 lists the various level error codes, what caused the problem and the recommended recovery action. If more than one error occurs, the error status returned will be returned on a worst condition basis. Example: For invalid block size detected and a tape media failure, the tape media failure condition will be returned as the status.

Summary Error Code	Dev Dep Error Code	Hdwr Error Code	Fault Symptom Code	Meaning	Recovery Action
'0000'X	N/A	N/A	N/A	REQIO NORM response. No error.	N/A
'0008'X	N/A	N/A	N/A	REQIO CONT response. No error.	N/A
'C009'X	N/A	N/A	N/A	REQIO partially processed due to RESET session.	ACTIVATE must be issued to restart processing, or a DEACTIVATE must be issued to destroy the session.
'C00A'X	N/A	N/A	N/A	REQIO not processed due to RESET session.	ACTIVATE must be issued to restart processing, or a DEACTIVATE must be issued to destroy the session.
'C00B'X	N/A	N/A	N/A	Partial damage detected.	A machine malfunction has been detected which affects all devices. A 'Partial System Obj Damage' event has been signaled. All tape jobs must be restarted. VARY OFF all LUD's and the CD before restarting.
'C016'X	N/A	N/A	N/A	Tape mark sensed.	Issue a REQIO CONTINUE for processing to resume.
'C017'X	N/A	N/A	N/A	End Of Tape sensed.	The End Of Tape was sensed during an I/O operation, issue a REQIO CONTINUE to restart drive. (Note: continued use may cause the tape to run off reel.)
'C019'X	N/A	N/A	N/A	Device status changed from Not Ready to Ready.	Issue a REQIO CONTINUE for processing to resume.
'C043'X	N/A	N/A	N/A	SSD buffer alignment invalid.	Correct SSD pointer or blocking and re-issue REQIO followed by a REQIO CONTINUE.
'C044'X	N/A	N/A	N/A	SSD buffer too small.	Make smaller blocks or larger SSD, perform any higher level recovery necessary if data may have been lost, then reissue REQIO followed by a REQIO CONTINUE.
'C084'X	N/A	N/A	N/A	SSD pointer invalid.	Correct pointer, re-issue REQIO followed by a REQIO CONTINUE.
'C085'X	N/A	N/A	N/A	Function field invalid.	Correct REQIO, re-issue REQIO followed by a REQIO CONTINUE.
'E010'X	'0001'X	'1000'X '1300'X '2000'X '3200'X '3300'X '3400'X '3500'X	'FFD0'X '0000'X '0000'X '0000'X '0000'X '0000'X 'FFD0'X	Subsystem failure. IOC Check. Disconnect error Cmdreject-FOB Disconnect-In Interface Chk Bus In Check Bus Out Check	Subsystem error which affects all devices. Position of tape is indeterminate. The CD Failure Event is also signaled for these cases. If a retry is attempted, it must include a VARY OFF and a VARY ON of the CD. If the error persists, call the CE.

Summary Error Code	Dev Dep Error Code	Hdwr Error Code	Fault Symptom Code	Meaning	Recovery Action
		'3600'X	'0000'X	Status Error	
		'4000'X	'0000'X	Channel resp	
		'4100'X	'0000'X	Channel Ovrn	
		'5100'X	'FXXX'X	Bus Out Check	
		'5120'X	'FXXX'X	Type Control	
		'5130'X	'FXXX'X	Drive Failure	
		'5400'X	'FXXX'X	Overrun	
		'5F00'X	'FXXX'X	Word count=0	
		'6100'X	'FXXX'X	Unit Check other	
		'7000'X	'FFD0'X	Inv B/D Stat	
		'7100'X	'FFD0'X	Read sense	
		'7200'X	'FFD0'X	Stack overflow	
		'7700'X	'FFD0'X	FOB timeout	
		'7800'X	'FFD0'X	IOM error	
		'9700'X	'0000'X	Channel error	
		'9800'X	'0000'X	Op Pgm error	
		'3800'X	'FFC0'X	HDC Hardware Error	
		'3900'X	'FFE0'X	Interface Hardware Error	
		'3A00'X	'FFC0'X	Compress Hardware Error	
		'3B00'X	'3B00'X	Microcode Detected Error	
		'3D00'X	'FFE0'X	I/O Hardware Error	
'E010'X	'0002'X			Tape drive failure.	Permanent tape drive failure on a single device. Position of the tape is indeterminate. The LUD Failure Event is also signaled for these cases. If a retry is attempted, it must include a VARY OFF and a VARY ON of the LUD. If the error persists, call the CE.
		'1200'X	'0000'X	Unsuc PE comp.	
		'5200'X	'FXXX'X	Intervent Req.	
		'5300'X	'FXXX'X	Write Protect.	
		'5800'X	'FXXX'X	Data Chk (Read)	
		'6000'X	'FXXX'X	Unit Check (DSE) with LWR failure	
		'5A00'X	'FXXX'X	Data Chk (Write) with LWR failure	
'E010'X	'0006'X	'5300'X	'FXXX'X	Write ring is missing.	Correct problem, reissue REQIO, followed by a REQIO CONTINUE.
'E010'X	'0007'X	'5D00'X	'FXXX'X	Wrong input tape (Not PE and not GCR).	Mount a tape capable of the proper recording density - (1600 PE or 6250 GCR).
'E010'X	'0010'X	N/A	N/A	Invalid RD Cmd. Command not recognized.	Correct RD and reissue REQIO followed by a REQIO CONTINUE.
'E010'X	'0012'X	'5000'X	'FXXX'X	Equipment Check.	Tape position is indeterminate. If all the tape has run off the user's reel, check the tape to be sure that an EOT marker is located about 25 feet from the end of the tape. If none is present, attach one and reprocess the tape. If an EOT marker is present and Error C017 has previously occurred, a program error is indicated. If all the tape has not run off the end of the user's reel, the tape could be faulty or a permanent tape drive failure has occurred.
'E010'X	'0014'X	'5E00'X	'FXXX'X	ID Burst Check.	Move BOT marker 2 CM to the right and reissue the command.

Summary Error Code	Dev Dep Error Code	Hdwr Error Code	Fault Symptom Code	Meaning	Recovery Action
'E010'X	'0018'X	'3000'X	'0000'X	Select in error, Disabled or Powered off.	Vary off the tape subsystem. If Enable/Disable switch is in the Disabled position, move it to the Enabled position. Also ensure remote power switch is in the remote power position. Otherwise power the subsystem Off and ON. Vary subsystem back on, activate sessions, and reissue the REQIO.
'E010'X	'0019'X	'5700'X '5900'X	'FXXX'X 'FXXX'X	Possible tape media failure. Data Chk (Read) with LWR good Data Chk (Write) with LWR good	A retry may be attempted after doing a space block in the opposite direction of the failing command. If retrying is not successful, try a different tape or clean the heads and columns. If error persists, call the CE.
'E410'X (note 7)	'0020'X	'3700'X '3C00'X '0000'X	'3700'X '3C00'X N/A	Media format error SCB Error Block Size encountered on the tape exceeds 32768 bytes Detected while performing Software Decompression	The tape on which read operations are being attempted does not meet the requirements for the decompression operation for one of the reasons indicated. Mount a proper tape.
'E014'X	'0008'X	'5200'X	'FXXX'X	Tape Drive not ready, but at BOT.	Make the drive ready and re-issue the command.
'E014'X	'0012'X	'2500'X	'0000'X	Tape Drive Busy, searching for BOT, or a long running disconnected command has not completed.	Wait, reissue command and REQIO CONTINUE.
'E014'X	'0013'X	'5200'X	'FXXX'X	Tape Drive not ready.	Make the drive ready and re-issue the command.
'E018'X	'000A'X	'5500'X	'FXXX'X	Tape moving backward at BOT.	Check program to verify correct logic and issue a REQIO CONTINUE.
'E018'X	'000B'X	N/A	N/A	Wrong length record detected by device.	If unexpected, check command modifier for correct block size and issue a REQIO CONTINUE.
'E018'X	'000C'X	N/A	N/A	Tape Drive ready, but not at BOT.	Issue rewind command and REQIO CONTINUE.
'E041'X	'1001'X	N/A	N/A	SSD destroyed.	Reallocate SSD, perform any higher level recovery necessary if data may have been lost, then reissue REQIO followed by a REQIO

Summary Error Code	Dev Dep Error Code	Hdwr Error Code	Fault Symptom Code	Meaning	Recovery Action
	'1002'X			SSD truncated or suspended.	CONTINUE.
	'1003'X			SSD damaged.	
'E087'X	'000D'X	N/A	N/A	Invalid block size specified. Block size is less than 18 or more than 32768.	Correct the block size, reissue REQIO followed by a REQIO CONTINUE.
'E087'X	'000E'X	N/A	N/A	The Number of Operations to Perform is less than or equal to the Operations Performed.	Insert or correct the operations to perform field in the RD, reissue REQIO followed by a REQIO CONTINUE.
'E087'X	'0015'X	N/A	N/A	Reserved fields in RD not zero. Note that no processing on the REQIO has occurred and the RD number field in the FBR will contain zero.	Correct the RD, reissue REQIO followed by a REQIO CONTINUE.

- Note 1: For Feedback Error Codes 'E010 0001', 'E010 0002' and 'E010 0018' there will be no Hardware Error Code and no Fault Symptom Code returned if the codes have already been returned in a previous Feedback record for the same problem (even in a Feedback record for a different device).
- Note 2: For Feedback Error Codes 'E014 0008' and 'E014 0013', there will be no Hardware Error Code and no Fault Symptom Code returned if they occurred on an FOB 'Mode Set' command issued on behalf of a REQIO 'Check Tape' command.
- Note 3: For Fault Symptom Codes of 'FXXX'X, DSTAT Byte 13 and DSTAT Byte 14 are used to make the FSC.
- Note 4: When the specified recovery action is to 'issue a REQIO CONTINUE', a MODLUD RESET followed by a MODLUD ACTIVATE would also work.
- Note 5: When the recovery action indicates that the tape job must be restarted, a MODLUD Vary Off and Vary On is required. (Subsystem errors may also require a Vary Off and Vary On of the CD.)
- Note 6: Tape position for terminating errors - the position of the tape for terminating errors will be the position the tape was left in by the hardware for the particular error. For example, for error 'E010 0019', the tape position would be beyond the interblock gap in the direction of travel.
- Note 7: This error only occurs for Load/Dump operations so the L/D indicator '0400'X is 'or'ed in which causes E410 instead of E010.

Table 2: 3430 Errors by RD Commands

Feedback Error Summary	RD Command														
	0	0	0	0	1	1	1	2	2	3	3	4	5	B	B
	1	2	A	B	2	4	C	4	C	4	5	C	4	4	5
C016		X			X	X	X								
C017	X												X		
C041	X	X			X										
C043	X	X			X										
C044	X	X			X										
C084	X	X			X										
E010 0006	X											X	X		
E010 0007		X			X	X		X							
E010 0012	X	X			X	X	X	X	X	X	X	X	X	X	X
E010 0014	X											X	X		
E010 0019	X	X			X										
E410 0020		X													
E014 0008				X											
E014 0012	X	X	X		X	X	X	X	X				X		
E014 0013				X											
E018 000A					X		X		X						
E018 000B		X			X										
E018 000C			X	X											
E087 000D	X	X			X										
E087 000E	X	X			X	X	X	X	X				X		
All other errors			(Any Command)												
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

RD Commands (see Section 4.8.6.1)

'01'X - Write Block
 '02'X - Read Block
 '0A'X - Check Tape - immediate
 '0B'X - Check Tape - delayed
 '12'X - Read Block Backwards
 '14'X - Space Block Forward
 '1C'X - Space Block Backward
 '24'X - Space File Forward
 '2C'X - Space File Backward
 '34'X - Rewind - delayed
 '35'X - Rewind - immediate
 '4C'X - Clear Tape
 '54'X - Write Tape Mark
 'B4'X - Rewind/Unload - delayed
 'B5'X - Rewind/Unload - immediate

Subtype 02 (unsuccessful contact) is not signaled on behalf of the tape subsystem, since the MODIFY CD will be terminated and an exception will be signaled instead. See the next section for exception cases.

4.8.1.7 EVENTS and EXCEPTION CODES

EVENTS

The following events are signaled. For a complete description of the following events, see Chapter 8 of this document.

- CD Contact Event (0004 04 01 02)

This event is signaled when the VARY ON processing is completed for this CD. This processing is done synchronous to the execution of the MODIFY CD (Vary On) instruction so only subtype 01 (successful contact) is signaled.

- CD Failure Event (0004 05 01)

The CD failure event is signaled and an error log entry made whenever the entire subsystem receives a permanent error. As part of the recovery action for this event, the CD should be varied off and then varied back on before attempting further operations. The variable data provided for this event is formatted as follows:

- Bytes 0-1
Status - contains a hardware error code which further defines the specific error

encountered. For this event, the hardware error codes which are listed in Table 1 of this section (Feedback Record) under the error summary codes for Subsystem Failure ('E010 0001'X) will be provided here.

- Bytes 2-9
Time stamp - contains the time stamp of the corresponding error log message.
- Bytes 10-11
OU number - '0052'X.
- Bytes 12-13
Fault Symptom Code (FSC).

• LUD Contact Event (000B 06 01 02)

This event is signaled when the LUD Vary On processing is completed. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details. Subtype 01 is signaled upon successful contact, however, subtype 02 (unsuccessful contact) is never signaled for Tape devices. In these cases, the MODIFY LUD (VARY ON) instruction signals an exception instead. This exception can occur for the same reasons which the CD failure event is signaled.

• LUD Failure Event (000B 08 01)

The device failure event will be signaled and an error log entry made whenever a tape drive has an uncorrectable problem (ie, where the recovery action is to call the CE). As part of the recovery action for this event, the LUD should be varied off and then varied back on before attempting further operations. The variable data provided for this event is formatted as follows:

- Bytes 0-1
Status - contains a hardware error code which further defines the specific error encountered. For this event, only the hardware error codes which are listed in Table 1 of Section 4.8.6.2 (Feedback Record) under the error summary code for Tape Drive Failure ('E010 0002'X) will be provided here.
- Bytes 2-9
Time stamp - contains the time stamp of the corresponding error log message.
- Bytes 10-11
OU number - '0052'X.
- Bytes 12-13
Fault Symptom Code (FSC).

• REQIO Complete Event (000B 09 01)

The REQIO complete event will be signaled if the user requests it. See REQIO for details.

• Response Queue Destroyed Event (000B 0A 01)

The response queue destroyed event is signaled

if the user truncates or destroys the Request I/O Response Queue while the machine is processing REQIOs.

EXCEPTION CODES SIGNALLED BY TAPE SUPPORT

Modify CD Exception Codes for Resource Not Available

For the 3430 Tape CD object, the S/S Resource Not Available Exception ('3404'X) is only raised by the MODIFY CD instruction for the following state change modifications:

Command	Generic	Specific-Code	
VARY ON	'2202'X	'0001'X	I/O Control Failure. CD failure event has also been signaled.
POWER ON	'2206'X	'0602'X	Power failure occurred. The CD failure event has also been signaled.
POWER OFF	'2207'X	'0602'X	Same as above.

Modify LUD Exception Codes for Resource Not Available

For the 3430 tape LUD objects, the S/S Resource Not Available exception ('3404'X) is only raised by the MODIFY LUD instruction for the following state change modifications:

Command	Generic	Specific-Code	
DEVICE SPEC AREA	'2300'X	None	Not signaled.
VARY ON	'2302'X	None	Not signaled.
ACTIVATE SESSION	'2303'X	'C4C0'X	Invalid storage pool specification for a Load/Dump session. Not signaled until follow-on L/D enhancements are available.
RESUME SESSION	'2311'X	None	Not signaled.
SUSPEND SESSION	'2312'X	None	Not signaled.
QUIESCE SESSION	'2313'X	'1302'X	Quiesce rejected due to terminating error condition.

4.9 RESERVED



4.10 LOCAL DEVICE AND CONTROLLER ERROR RECOVERY PROCEDURES

4.10.1 HARDWARE ERROR CODES

The following tables define the error codes and different actions or definitions based on them. The tables have the following meanings:

Table 1 - This lists all the error codes for all of the local device IOMs, what the probable cause is, the event that is signaled, and the correct recovery action to be performed.

Table 2 - This table lists the probable error locations.

Table 3 - This table lists the recommended recovery actions for each of the hardware error codes.

The following rules applied to generating the error recovery actions:

- If the problem is caused by the far end or the application program the job should be rerun before running the Problem Determination Procedure.
- If the problem is due to the local device hardware, the Start Problem Determination command should be run before rerunning the job.

The Start PDP command was designed to catch hardware failures.

- If the problem is due to the remote station software the job is to be rerun before the Problem Determination Procedure is run.
- Repair Action column in table 4 is a list of ideas to try before rerunning the job or calling the CE for help.

Table 1 SUMMARY OF ERROR CODES AND ACTIONS

The following is a list of the event types and the code used to define them within the following table. It should be noted that only the events that would result in a error code being passed up to the user are defined. All the other error codes listed may cause another event (eg. unsuccessful contact or intervention required) but are not themselves passed as event related data or one of the failure events. These error codes have an X in the event column only to indicate whether they are control unit, or device related.

<u>Code</u>	<u>Event Type</u>	<u>Event</u>
C1	Control unit failure	0004-05-01
L1	LUD failure	000B-08-01
X	Not applicable	None

	CM33733 OF22244 NC60M13 SU23D00 O - / L 5 1 E 1		ERROR LOCATION/REPAIR ACTION (See Table 2)				
				EVENTS			
			V V	V V	V V	V V	
HARDWARE ERROR CODE	DEVICE TYPE CMPPD TT 2 2	ERROR EXPLANATION (See Table 4)	ERR LOC --- REP ACT		CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
0100	D	Op program error	2			L1	1,3
0101	C	Channel error or OU task failure	2			L1	1,3
0101	D	Unrecoverable - channel error (OU task failure)	2			L1	1,3
0103	D	Overrun	2			L1	1,3
0104	D	Disconnect	2			L1	1,3
0105	D	Parity Error 1	2			L1	1,3
0106	D	Parity Error 2	2			L1	1,3
0107	D	Command reject	2			L1	1,3
0108	D	CTL addr mark	2			L1	1,3
0201	C	CRT Cable out	2			L1	1,3
0201	D	Wrap error	2			L1	1,3
0202	C	Keyboard cable out	2			L1	1,3
0202	D	AL parity error	2			L1	1,3
0203	C	Screen buffer parity error	2			L1	1,3
0203	D	INV AL func code	2			L1	1,3
0204	C	Screen buffer and DBI parity error	2			L1	1,3
0204	D	FOB timeout AL CMD	2			L1	1,3
0205	C	Keyboard overrun	2			L1	1,3
0205	D	Erase current error	2			L1	1,3
0206	C	Invalid KBD scan code	2			L1	1,3
0206	D	AL CMD rej MOD 'D'	2			L1	1,3
0207	D	WRT gate error	2			L1	1,3
0208	D	FOB timeout non-AL CMD	2			L1	1,3
0301	C	Post event	2			L1	1,3

	CM33733 OF22244 NC60M13 SU23D00 O - / L 5 1 E 1		ERROR LOCATION/REPAIR ACTION (See Table 2)				
				EVENTS			
			V V	V V	V V	V V	
HARDWARE ERROR CODE	DEVICE TYPE CMPPD TT 2 2	ERROR EXPLANATION (See Table 4)	ERR LOC --- REP ACT		CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
0301	D	AL motion check	2			L1	1,3
0302	C	Invalid disconnect	2			L1	1,3
0302	D	AL motion check	2			L1	1,3
0303	D	AL motion check	2			L1	1,3
0304	D	AL motion check	2			L1	1,3
0306	D	AL CMD rej (not oriented)	2			L1	1,3
0307	D	AL CMD rej (out of seq)	2			L1	1,3
0401	C	Invalid BSTAT/DSTAT	2			L1	1,3
0402	C	FOB timeout	2			L1	1,3
0405	D	IDCRC err on read data	2			L1	1,3
0504	D	Read sense error	2			L1	1,3
0505	D	Inv B/D stat data	2			L1	1,3
0506	D	Unexpected B/STAT on RD Sense	2			L1	1,3
0507	D	AL PAR ERR on RD sense	2			L1	1,3
0508	D	Retry stack limit exceeded	2			L1	1,3
050A	D					L1	1,3
050C	D	Can't flag bad cyl (format)	2			L1	1,3
1000	T 2	IOC check	2		C1		1,4,3
1100	T	Channel Error	2		C1		1,4,3
1200	T 2	Unsuccessful PE Completion	2			L1	1,3
1300	T	Operation Program Error	1		C1		1,4,3
1300	T 2	Disconnect error	2		C1		1,4,3
1400	T	Channel error -	2		C1		1,4,3

	CM33733 OF22244 NC60M13 SU23D00 O - / L 5 1 E 1		ERROR LOCATION/REPAIR ACTION (See Table 2)				
				EVENTS			
			V V	V V	V V	V V	
HARDWARE ERROR CODE	DEVICE TYPE CMPPD TT 2 2	ERROR EXPLANATION (See Table 4)	ERR LOC --- REP ACT		CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
3400	T 2	Bus in check	2		C1		1,4,3
3500	T 2	Bus out check	2		C1		1,4,3
3600	T 2	Status error	2		C1		1,4,3
4000	T 2	Channel response	2		C1		1,4,3
4100	T 2	Channel overrun	2		C1		1,4,3
4100	T	CMD Reject - Sense Required ABI/ABO Parity Error-Status Update	2		C1		1,4,3
4101	PP 2	FOB timeout	2			L1	1,3
4102	PP 2	Invalid adapter response	2			L1	1,3
4103	PP 2	Startup command failure	2			L1	1,3
4105	P	ERP failure-- (except timeout or channel error) on RD sense	2			L1	1,3
4106	P	ERP failure (timeout or channel error) on RD sense	2			L1	1,3
4107	P	ERP failure (except timeout or channel error) on RD ERRLOG	2			L1	1,3
4108	P	ERP failure (timeout or channel error) on RD ERRLOG	2			L1	1,3
4110	P 2	Read sense or adapter reset failure	2			L1	1,3
4111	P 2	Read IOC sense, or read line total, or read error log error	2			L1 L1	1,3 1,3
4200	T	ABI/ABO Parity Error - ABI Parity	2		C1		1,4,3

	CM33733 OF22244 NC60M13 SU23D00 O - / L 5 1 E 1		ERROR LOCATION/REPAIR ACTION (See Table 2)				
			V V	EVENTS		V V	
				V V	V V		
HARDWARE ERROR CODE	DEVICE TYPE CMPPD TT 2 2	ERROR EXPLANATION (See Table 4)	ERR LOC --- REP ACT		CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
4300	T	ABI/ABO Parity Error - ABO Parity	2		C1		1,4,3
4400	T	ABI/ABO PAR ERR-ABI PAR Attach	2		C1		1,4,3
5100	T	Illegal command error	2		C1		1,4,3
5100	T 2	Bus out check	2		C1		1,4,3
5200	T	ABO Error	2		C1		1,4,3
5200	T 2	Intervention Required	2			L1	1,3
5300	T	Control Tag	2		C1		1,4,3
5300	T 2	Write Protect error	2			L1	1,3
5400	T	INSTR Tag	2		C1		1,4,3
5400	T 2	Overrun	2		C1		1,4,3
5434	P	Thermal check 1	2			L1	1,3
5435	P	Thermal check 2	2			L1	1,3
5451	P	Contactor stuck	2			L1	1,3
5500	T	ALU Error	2		C1		1,4,3
5501	T	ALU Error	2		C1		1,4,3
5600	T	ROS Error	2		C1		1,4,3
5700	T	XFR Error	2		C1		1,4,3
5800	T 2	Read data check with LWR failure	2			L1	1,3
5A00	T 2	Write data check with LWR failure	2			L1	1,3
5C00	T 2	Data check - Write tape mark	2			L1	1,3
5F00	T 2	Word count = 0	2		C1		1,4,3
6000	T 2	Unit check data security erase	2		C1		1,4,3

	CM33733 OF22244 NC60M13 SU23D00 0 - / L 5 1 E 1		ERROR LOCATION/REPAIR ACTION (See Table 2)				
			EVENTS				
			V V	V V	V V	V V	
HARDWARE ERROR CODE	DEVICE TYPE CMPPD TT 2 2	ERROR EXPLANATION (See Table 4)	ERR LOC --- REP ACT		CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
6100	T	Command reject - sense required,status update interface err	2		C1		1,4,3
6100	T 2	Unit check (other)	2		C1		1,4,3
62XX	T	3411 Interface Tag Error XX=DSTAT 5	2		C1		1,4,3
6300	T	Initial error	2		C1		1,3
7000	T 2	Invalid BSTAT/ DSTAT	2		C1		1,4,3
7100	T	Lamp check	2			L1	1,3
7100	T 2	Read sense	2		C1		1,4,3
7200	T 2	Stack overflow	2		C1		1,4,3
7300	T	Ready reset	2			L1	1,3
74XX	T	Reject tape unit	2			L1	1,3
7600	T	Tach check	2			L1	1,3
7700	T 2	FOB timecount	2		C1		1,4,3
77XX	T	RB data check	2			L1	1,3
7800	T 2	IOM error	1		C1		1,4,3
8400	T	3411 Hardware Error	2		C1		1,4,3
8800	T	Illegal Command	2		C1		1,4,3
8900	T	Status change	2			L1	1,3
8A00	T	Word count = 0	2		C1		1,4,3
8C00	T	Drive not attached	2			L1	1,3
9700	T 2	Channel error	2		C1		1,4,3
9800	T 2	OP program error	2		C1		1,4,3
B0XX	T	Data check - ERG	2			L1	1,3

	CM33733 OF22244 NC60M13 SU23D00 O - / L 5 1 E 1		ERROR LOCATION/REPAIR ACTION (See Table 2)				
				EVENTS			
			V	V	V	V	
			V	V	V	V	
HARDWARE ERROR CODE	DEVICE TYPE CMPDDTT 2 2	ERROR EXPLANATION (See Table 4)	ERR LOC --- REP ACT		CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
B1XX	T	Write Errors	2			L1	1,3
B200	T	Attachment/3411 Overrun	2		C1		1,3
B300	T	Bus out check	2			L1	1,3
B600	T	End velocity check	2			L1	1,3
C1XX	T	Read Errors	2			L1	1,3
C200	T	Attachment/3411 Overrun	2		C1		1,4,3
E110	T	Read Sense Failure during Error Recovery	2		C1		1,4,3
E120	T	Retry Stack Overflow	1		C1		1,4,3
E130	T	IOM error	1		C1		1,4,3
E140	T	Clear command Failed	2		C1		1,4,3
E150	T	Mode set command failed	2		C1		1,4,3
E160	T	Read sense Command Failure	2		C1		1,4,3
E170	T	Reset command failed	2		C1		1,4,3
E210	T	Invalid BSTAT/DSTAT Data	2		C1		1,4,3
E290	T	FOB Timeout	2		C1		1,4,3

4.10.2 ERROR RECOVERY DESCRIPTIONS

Table 2 PROBABLE ERROR LOCATION/REPAIR ACTION

1. Problem in IBM software (VMC), call the PSR.
2. Problem in IBM hardware or HMC, call the CE.
3. Intervention required at the device, inform the operator.
4. Problem in system overcommitment of resources, inform the operator.

Table 3 ERROR RECOVERY ACTIONS

1. Vary off LUDs and Vary off CD (if a CD failure event was signaled).
2. Perform intervention action required at the device.
3. Refer to PDP Key description in PDP Guide, Appendix A.
4. Do recovery action 1 for all devices on failing IOC subsystem, then do recovery actions for all jobs affected.
5. Verify correctness of the system objects (LUD,CD).

ACRONYMS

ABI	Adapter Bus In
ABO	Adapter Bus Out
ALU	Arithmetic logical Unit
BSTAT	Basic Status
CRC	Cyclic Redundancy Check
CRT	Cathode Ray Tube
CSA	Card System Adapter
DACTLU	Deactivate Logical Unit
DBI	Data Bus In
DSTAT	Device Status
EOT	End of Transmission
FMD	Function Management Data
FOB	Function Operation Block
IC	Illegal Command
INSTR	Instruction
IOC	Input Output Controller
IOM	Input Output Manager
KBD	Keyboard
LRC	Longitudinal Redundancy Check
LWR	Loop Write to Read
MI	Machine Interface
MS	Main Storage
MSCP	Machine Service Control Point
OP	Operation
ORE	Operation Request Element
OU	Operation Unit
PDP	Problem Determination Procedure
RB	Read Backward
ROS	Read only storage
VRC	Vertical Redundancy Check
XFR	Transfer

5.0 COMMUNICATIONS

5.1 MACHINE SERVICES CONTROL POINT (MSCP)

The MSCP is the VMC component that coordinates supervisory service requests for all users of the Source/Sink functions. Requests for services may be processed directly by the MSCP or may be redirected to other supervisory components that will provide the requested function. Supervisory service requests include:

- Internal machine functions associated with VARYing ON and VARYing OFF of a line, station (PU) or device (LU).
- Switched connection support such as initiating and completing calls.
- Requests initiated at a remote LU (ie, SNA Session, and Conversation allocation).
- Error recovery procedures.

There are certain resource requests ATTACH (Program Start) received by the MSCP that cannot be serviced within the machine. To assure that these requests are properly serviced, there must always be a process with the responsibility for handling these requests. Dependent on the conditions that exist the system protocol may require further communication with the MSCP or with the LU that initiated the request.

5.1.1 MODIFY/MATERIALIZE SS OBJECT

Many of the functions provided by the MSCP are implicitly requested when a SS MODIFY instruction is executed to VARY ON or VARY OFF a component. Some of these functions are not apparent at MI, particularly the activation of the LU Sessions. However, for communications devices the availability, allocation, and use of these resources must be understood by the MI user.

Modify/Materialize Network Description (MODND)

During the VARY ON processing as part of MODIFY ND, the MSCP is requested to activate the link represented by this ND. Activation of the link includes all the logical and physical initialization required before a remote PU on that link can be contacted. When the ND is for a Leased line the line is prepared for transmitting to the attached PU. When the ND being activated (VARIED ON) represents a connection into the switched network, that communications adapter is initialized but will not be prepared for calls until it has been placed in the Switched Enabled State by a MODIFY ND (enable). Once placed in this state, its usage is governed by the option specified in the Switched Connect Method Field. If "Dialin" is specified, the

link is activated for incoming calls. If "Dialout" is specified, the link is activated for outgoing calls. If either dialin or dialout is specified, the link is activated for incoming calls. Should it be necessary to use this facility for a dial out call before a dial in has occurred, the resource is available and can be so allocated. Allocation and use of switched line facilities is controlled via the MODIFY instructions to VARY ON and OFF LUDs, CD's and ND's and by maintaining an ND candidate list in the CD for each remote station capable of using the switched network, or by maintaining a CD eligibility list in BSC switched ND's.

Also for RAM loadable controllers, RAM loads will be done as part of Vary On processing.

Modify/Materialize Controller Description (MODCD)

A request is initiated during processing of MODIFY CD - VARY ON directing the MSCP to establish contact with the appropriate remote station.

While the MSCP is always requested to contact a remote station during VARY ON CD processing, physical contact with the remote station cannot always be made at this time. The remote station cannot be contacted if a switched connection is required and has not been completed or if the remote station is not varied on line for a leased connection.

The following sequence describes the state of the CD object resulting from the processing of the MODIFY CD (Vary On) instruction:

- The CD object is set to a VARY ON PENDING state and the MODIFY CD instruction is completed. The remaining activity is performed asynchronously by the MSCP.
- When the remote station is contacted the CD is brought to the VARIED ON state and the CD Contact Successful event (0004,04,01) is signaled.
- The CD object is set to ACTIVE; LUDs VARIED ON state whenever the first LUD attached to this controller completes the Vary On processing being performed by the MSCP.
- The CD object is set to ACTIVE SESSION state whenever the first LUD attached to this controller completes the asynchronous LUD Vary On processing being performed by the MSCP and the LUD state indicates the RESET, QUIESCE, SUSPEND, or ACTIVE SESSION state or a Modify LUD Activate Session is issued.
- The CD status is set to Active (for APPC) when the first session is bound for any LUD attached to the CD.

- The CD status is set to Active (for all except APPC) when the first Activate Resource REQIO for any LUD attached to the CD is returned.

The network resources are allocated and the connection established as a result of an incoming call being received, an explicit request (MODIFY CD-DIAL) to dial out is initiated by an MI process or the remote station is varied on line. Upon completion of the connection, the MSCP receives the Exchange ID (XID) information as sent by the remote station. The MSCP validates the identity of the far end station and completes the processing based on the following checks:

- The Exchange ID matches the Exchange ID field in the controller description.
- The CD object indicates the VARIED ON state.
- The ND representing the line on which the call is made is included in the ND candidate list of this CD.

To put it another way: the remote station must be known to the system, must not be VARIED OFF, and must be allowed to use this line. If any of these checks fail, the connection is broken and the appropriate MI event is signaled.

For locally attached control units (WSC, tape, etc), Vary On processing is completed synchronously to the MODCD instruction. If the controllers are RAM loadable, RAM load is completed at this time.

MODCD(dial)/Asynchronous Answer--SDLC Networks

The switched network resources are allocated and the connection established as a result of an incoming call being received or an explicit request (MODIFY CD-DIAL) to dial out is initiated by an MI process. Upon completion of the switched connection, the MSCP receives the station ID information as sent by the secondary station in response to an Exchange ID (XID) command or receives the SSCP-ID from a primary station. The MSCP validates the identity of the far end station and completes the VARY ON processing based on the following checks:

- The station ID or SSCP-ID matches the XID field or SSCP-ID field in a Controller Description.
- This CD is in the VARY ON PENDING state or DIALING OUT state.
- The ND representing the line on which the call is made is included in the ND candidate list of this CD.

To put it another way: the station must be known to the system, must not be VARYed OFF, and must be allowed to use this line. If any of these checks fail, the connection is broken and the appropriate MI event is signaled

Contact with the station is established and completion of the CD VARY ON always occurs

asynchronous to the process executing the MODIFY CD instruction. Completion of the VARY ON is signaled via the Controller Description contact event (Class X'0004; Type 4, Subtype 1).

MODCD(dial)/Asynchronous Answer--BSC Networks

Connection procedures for BSC are similar except that the "Remote XID list" in the CD is used to obtain the XID to compare against the XID received from the far end, and the field called "this sytem's XID" is used to provide the XID to be sent to the far end station and the type of XID comparison is determined by the ID type fields associated with each of the XIDs. Also the ND candidate list is used only for dial out (MODCD-DIAL) connection. On incoming calls the CD Eligibility List in the ND object is used to search for the appropriate CD.

For BSC networks operating in MTAM mode (Release 4) the SIGNON/LOGON is used in lieu of the XID lists.

Modify/Materialize Logical Unit Description (MODLUD)

When the LUD representing a local or direct attached device is VARYed ON, all necessary functions are synchronously completed and the LUD goes to the VARY ON state before the MODIFY LUD instruction completes. If the RAM load indicator in the Machine Configuration Record (MCR) is set the RAM will be loaded at vary on.

SDLC LUDs

A LUD representing a logical unit attached to a station on a leased line or a station using the switched network facilities, attains the same states as the CD with which it is associated. That is, the VARY ON PENDING state is set until contact with the station is established, at which time the MSCP will complete all pending VARY ON function. At this time, the Logical Unit Description event Class X'000B', Type 6, Subtype 1, (successful contact) is also signaled, provided a positive response to ACTLU with device available indication has been received.

During VARY ON LUD processing, the MSCP sends (or receives for SDLC secondary) the ACTIVATE LOGICAL UNIT (ACTLU) session control message to the logical unit to establish an MSCP-LU session. This session will remain active as long as the LUD is in the VARY ON state. It is the responsibility of the MSCP to terminate this MSCP-LU session as well as to control the routing of all messages flowing on this session.

Once the MSCP-LU session has been established, the logical unit can initiate unsolicited requests to the MSCP. Since the MSCP cannot always service these user requests, machine events are used to make the information available to an MI process. The events, request data, and procedure for servicing the request are discussed in more detail in the following sections.

APPC LUDS

A LUD associated with a remote LU on a leased line, or a remote LU using the switched network facilities, attains the same states as the CD with which it is associated.

The LUD object is set to a VARIED ON state when the MSCP completes the pending Vary On function. When the connection (CD Contact) is established, or if the connection already has been established, the LUD Contact Successful Event class '000B'X, type 6, subtype 1 is signaled. At this time the Request I/O (Activate Resource) command may be issued, followed by MODLUD (Activate) and then data transfer may be started.

During the LUD Activation processing, the MSCP initiates the required sequences to establish the SNA Session resource by which Conversations are allocated to engage in the exchange of information between two programs. The LUD object is set to ACTIVE SESSION state and the remaining activity is performed asynchronously by the MSCP.

Once the SNA session has been established, the remote LU can initiate unsolicited ATTACH (Program Start) requests initiated by a Transaction Program at the remote PU. Since the MSCP does not service these requests, it is necessary for the MI user to acquire an MSCP-LU session Conversation ID for the Attach Manager that has the logic required to connect a Transaction Program for which the Attach requests has been received. This is accomplished by a Activate Resource REQIO (Attach Manager) to allocate the Conversation ID and will allow the MI process to issue REQIOs on the MSCP-LU flow to receive the Attach data and machine assigned Conversation ID. The MI process that receives the Attach has the responsibility to send the SNA response to the remote Transaction Process that originated the request. If any errors are detected by the MI User during the ATTACH processing, they should be reported to the remote LU, and then the MI User should issue a Deactivate Resource REQIO for the machine acquired Conversation ID. When the Attach Manager Conversation is not activated the Machine will send an FMH-7 X'084B6031' to the remote Transaction Process that originated the request and raise the LUD Unsolicited Message Event (000B,05,22); when the Attach Manager Conversation is activated the Machine will hold the request enqueued until a REQIO is received on the Attach Manager Conversation (no event will be raised). The data returned by the Machine to the REQIO's SSD space is specified in Section 5.3.4.4.

BSC LUDS

A LUD representing a logical unit using switched network facilities attains VARY ON PENDING state along with its CD, until a connection with the controller is established, at which time the MSCP will complete the pending VARYON function. When the connection is established, LUD event class X'000B' type 6, subtype 1 (successful contact) is signaled. At this time, the Request I/O (Activate Resource) and MODLUD (Activate) can be issued to the device and data transfer begins. The LUD event class X'000B' type 5, subtype 4 (line bid received) is signaled whenever traffic begins on the line.

5.1.2 MSCP-MI INTERFACE

The MSCP coordinates all supervisory service requests but does not necessarily provide the requested functions. That is, all supervisory service requests are sent to the MSCP, but the MSCP may in turn route the request on to the ultimate request processor. The MSCP can communicate with all logical units and physical units that are VARIED ON via the MSCP-LU and MSCP-PU sessions respectively. However, when requests are initiated by or destined for an MI process a different means of communication is required.

Requests are signaled to an MI process via architected machine events. The REQUEST I/O instruction, with the function field in the SSR set to indicate an MSCP message, is used by the MI process to route a response or a new request to the MSCP. As before, the MSCP is responsible for routing the message to the appropriate destination.

5.1.2.1 Supervisory Service Events

Several events are defined which require definite action to be taken by an MI process in order to continue normal processing. The handling of these events and servicing of the requests will be discussed for each event individually in the following sections.

CD EVENTS

CD Contact Successful Event (0004 04 01)

- This event is signaled when the VARY ON processing is complete and contact has been established with the remote station. For SDLC controllers, the MSCP-PU session is active at this time, meaning a positive response was received from the far end station to the ACTPU request or that System/38 responded positively to the far end primary station ACTPU request. For BSC controllers, the XID (or MTAM signon/logon) received from the far end station matches the indicated XID (or signon/logon) in this controller. The event related data includes a system pointer to the CD and a system pointer to the ND. No additional event related data is supplied for the subtype---the data area will contain binary zeros. The actual XID data received is not provided as event data but has been inserted directly into the XID information area of the CD object. This event is also signaled for local controllers (CD Type 00) directly upon completion of the MODIFY CD (vary on) instruction. There are no XID exchanges in these cases.

CD Contact Unsuccessful Event (0004 04 02)

- This event is signaled when the VARY ON processing being performed asynchronously by the MSCP fails. The event related data includes a system pointer to the CD, a system pointer to the ND and up to 66 bytes of data including a 2 byte status code which defines the failure reason, a length field and, in those cases where appropriate, the identification data (XID) received from the failing CPU. There are several failure cases which are described. (See Section 5.3, Section 8 and the individual IOM sections for more complete descriptions.)

CD Loss of Contact Event (0004 04 03)

- This event is signaled by the MSCP when an SDLC or BSC "DISC or an SDLC RD" is received from the remote station. The event related data includes a system pointer to the CD, a system pointer to the ND and a 2 byte status code '0001'X, which indicates: "DISC or RD" received from the remote PU or '0002'X which indicates a BSC OR MTAM disconnect.

CD Failure "Inoperative" Event (0004 05 01)

- This event is signaled by the MSCP whenever the controller is in an inoperative condition and is not usable. The event related data provides a system pointer to the CD, the Hardware Error Code, a Timestamp and OU number.

CD Failure "SSCP to PU Session Inactive" Event (0004 05 03)

- This event is signaled by the MSCP whenever the secondary support has received indication from the far end primary that the SSCP to PU session is inactive (i.e., DACTPU received).

CD Failure BSC MTAM Protocol Considerations Event (0004 05 04)

- Signaled by MSCP on behalf of BSC MTAM. Refer to MTAM section for details.

CD Manual Intervention Event (0004 06 01)

- This event is signaled by the MSCP when a request is received to establish a switched connection with a remote station and the link attachment to be used does not support the autodial feature. The event related data includes a system pointer to the CD representing the remote station to be called, a system pointer to the ND representing the line on which to place the call, and a two byte status code of '0001'X which indicates Manual Dial Operation

required. The MI process must materialize the CD and ND if it is necessary to retrieve additional information (for example, phone number and ND name or line number).

When the connection is made, a MODIFY ND (start data) is executed and the VARY ON CD processing will be completed as discussed earlier for incoming calls. If the operator responds to the MI process that the call cannot be completed, a MODIFY CD instruction maybe used to abandon the DIALING state of the CD (return to VARY ON PENDING) or to VARY OFF the CD.

CD Unbound Intervention Event (0004 06 02)

- This event is signaled for an APPC switched CD when all sessions for all LUDs attached to this CD are deallocated (Unbound).

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related is supplied for the subtype---the data area will contain binary zeros.

CD Switched Intervention Event (0004 06 03)

- This event is signaled by the MSCP for the following conditions:
 - When the first Activate Resource REQIO to activate the resource is received for any LUD, in a VARIED ON PENDING or higher state with the Recovery Activation status of CONTINUE, attached to a VARIED ON PENDING CD with the Recovery Activation status area indicating CONTINUE.
 - When the MODIFY CD Continue instruction is issued and an Activate Resource REQIO is present for any LUD attached to the CD.
 - When the MODIFY CD Abandon Connection is issued and an Activate Resource REQIO is present for any LUD attached to the CD. NOTE: This event will not be signaled when the only attached LUD(s) with Activate Resource REQIOs pending have the Recovery Activation Status of INOPERATIVE PENDING indicated.

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

CD Primary Intervention Event (0004 06 04)

- This event is signaled by the MSCP for a leased line (Primary only), when the first Activate Resource REQIO, to activate the resource, is received for any LUD with the Recovery Activation status of NORMAL PENDING attached to a CD with the Recovery Activation status area indicating NORMAL PENDING.

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

LUD EVENTS

LUD - Supervisory Service Request (000B 04 01,02)

Subtype 1 is signaled by the MSCP when an unformatted SNA request is received on the MSCP-LU session. This request can be initiated by an operator at a work station by pressing the SYSREQ key, keying in optional data, then pressing the ENTER key. When this message is received, the MSCP determines that the information is to be routed to an MI process and signals the event. The event related data consists of a system pointer to the LUD that identifies the logical unit that initiated the request. In addition, the data length field will indicate the number of bytes of SNA RU data that follows.

Subtype 2 is the machine event signaled when the MSCP receives a formatted SNA request on the MSCP-LU session. One example of a formatted request is the Request Test message sent when the TEST REQ key is pressed.

Event related data includes a system pointer to the LUD associated with the device that originated the request. The data length field will contain a count of the number of bytes of data in the TEST REQ message. The entire message (ie, SNA RU) is included in the event data just as for the unformatted requests.

Whenever the MSCP receives one of these requests on the MSCP-LU session, the event is signaled and the MSCP sends a positive SNA response to the device that originated the request.

LUD Unsolicited Messages Event (000B 05 01-10)

This event is currently signaled by the MSCP component on behalf of individual IOMs for certain subtypes. In each case where the event is signaled it is defined in the respective device management sections. Refer to each device section for details.

LUD Contact Event (000B 06 01,02)

Subtype 1 of this event is signaled to indicate successful completion of the VARY ON processing for this logical unit. For primary SDLC support the MSCP-LU session is active at this time, meaning a positive response was received to the ACTLU request

and the "device available" indication is set. If the device is not available this event is not signaled until a request (ie, LUSTAT) is received by the MSCP to indicate that the device is now available. For secondary SDLC support this event is signaled when an ACTLU has been received from the far end primary. For BSC and MTAM this event is signaled immediately upon successful completion of the Vary On processing.

Event data consists of a system pointer to the LUD, and a data length field which is set to zero.

Subtype 2 of this event is signaled when the VARY ON LUD processing failed, as in the case where a negative response to ACTLU is received. The event data will then include sense data or XID data and a reason code for why it failed. This data is defined in Section 8.1.2. For APPC, this event is signaled when a BIND was received from the remote LU for a LUD that has one of the following conditions indicated: the LUD is in the state of Varied Off, the Recovery Activation status indicates Inoperative Pending or Cancel. The Bind is held pending until a MODIFY LUD Vary On or Continue is received. The event related data provides a system pointer to the LUD and a two byte status code of '0006'x. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

LUD Failure Event (000B 08 01,02,03,04)

The MSCP signals Subtype 1 of this event on behalf of BSC devices. Refer to the BSC section for details. Subtype 2 of this event, Device Not Ready, is signaled by the MSCP whenever the LUSTAT is received indicating that a device that has an active MSCP-LU session is now unavailable. The event data includes a system pointer to the LUD, a data length of 14 bytes as defined in Section 8.1.2. The error code field in this data will contain the SNA LUSTAT message which was received from the device.

Subtype 3 is signaled by the MSCP whenever the far end primary station has indicated that the SSCP to LU session is no longer active (ie, DACTLU received). This is only for System/38 secondary support cases. The error code field in the event related data will contain '0001'X for this DACTLU case.

- The Subtype 4 is signaled by the MSCP whenever a Varied On LUD goes to a state where it no longer is maintaining the LU-LU flow. Refer to the Recovery Activation Status changes that occur when this event is signaled. The event related data indicates a 2-byte error code representing the following errors:

- '0001'x---LU failure: all LU-LU sessions had to be deactivated because of a forced termination of the LU (LUD).
- '0002'x---Invalid session parameters: the BIND negotiation has failed for all MODENAMES due to an inability to bind any session for this LU (LUD). Recovery may involve changes to the LUD Device Specific Area (DSA) at the S/38 or Remote LU.

Session Related Events (000B 09,01,02,03)

- This event indicates that the REQIO asynchronous processing has been completed. It is signaled only if the user requests it. The event related data provides a system pointer to the LUD, a 2 byte length of key and an "N" byte key from the SSR.
- Subtype 2 and 3 are signaled on behalf of APPC devices. Refer to APPC section for details.

Request I/O Response Queue Destroyed Event (000B 0A 01)

- This event is signaled to indicate that the return queue specified in the REQIO instruction has been destroyed. The Conversation ID is deallocated and the SNA Session is placed in an inoperative ERP state where all data is purged until the necessary synchronization is achieved to allow the session to be UNBOUND. The resources allocated to this session are retained and once the session is UNBOUND the inoperative condition is reset and the Session Resumed (BOUND) to allow reuse.

ND EVENTS

ND - Connection Failure Event (000E 04 01, 02, 03, 04, 05)

This event is signaled by the MSCP when switched line connection cannot be established and also is signaled for some leased configurations. Subtype 1 indicates that the XID received from a secondary SDLC station does not match the XID of any CD that is in VARY ON PENDING state so the line connection was not allowed to be established, or that a primary SDLC station has sent ACTPU data to System/38 which contains an SSCP-ID field which does not match the SSCP-ID of any CD that is in the VARY ON PENDING state.

Subtype 02, for BSC communications lines, indicates that the XID received from the calling station does not match the XID of any CD in the eligibility list of this ND.

Subtype 03, Disconnect failure, is signaled by MSCP whenever "DISC or RD" is received as a reply to the XID command. This condition is signaled for SDLC secondary leased configurations as well as for SDLC secondary and BSC switched configurations.

Subtype 04, BSC MTAM Eligibility failure, is signaled by the MSCP whenever the CD Eligibility list contains no entries which match the required attributes for MTAM mode. See section 8.1.3.

Subtype 05, XID Negotiation failure, is signaled by the MSCP for those cases where the line connection cannot be established because the remote Primary or Secondary PU sends SNA information out of sequence or XID negotiation fails. The event related data includes a system pointer to the ND, up to 66 bytes of data including a 2 byte status code which defines the failure reason, a length field and, in those cases where appropriate, the identification data (XIO) received from the failing CPU. There are several failure cases which are described in detail in Section 5.3, and in Section 8.

The event related data provides a system pointer to the ND, a length field, and the actual XID or SSCP-ID information which was received (up to 64 bytes).

ND - Line Failure Event (000E 05 01)

This event is signaled by the MSCP whenever unrecoverable line error conditions have occurred. Subtype 01 is signaled on behalf of the line IOM whenever the line IOM has experienced unrecoverable hardware error indications.

5.1.2.2 MSCP Request I/O (REQIO)

The MSCP coordinates all supervisory service requests but does not necessarily provide the requested functions. That is, all supervisory service requests are sent to the MSCP, but the MSCP may in turn route the request on to the ultimate request processor. The MSCP can communicate with all LUs and PUs that are VARIED ON (Varied On Pending or higher state) via the MSCP-LU session or MSCP-PU session. The REQUEST I/O instruction, with the function field in the SSR set to indicate an MSCP message, is used by the MI process to route the request to the MSCP. As before, the MSCP is responsible for routing the message to the appropriate destination. However, when requests are initiated by or destined for an MI process a different means of communication is required.

Refer to Sections 5.3.3 and 5.3.4 for complete details on MSCP Request I/O's for non-APPC and APPC calls respectively.

5.1.2.3 Modify/Materialize Machine Attributes

THE MACHINE ATTRIBUTE AREA WILL CONTAIN A CHAR(8) FIELD FOR THE System's LUNAME. This field will be used as the PLUNAME in all BIND images sent by the S/38 LU-C Support. It will be the NAME used by other systems to address/route to a particular S/38.

5.2 COMMUNICATIONS DEVICE MANAGEMENT - SNA/SDLC - (FOR WORK STATION AND LU1)

This section describes the programming considerations and specific device support requirements for communications Source/Sink devices. The devices may be either primary or secondary SNA/SDLC. Current support is for 5250 work stations through SDLC primary support and for LU1 session support through SDLC secondary. There exists two separate components, one for primary role and one for secondary role. The text will explicitly note the areas where differences do exist, otherwise the support is the same for both components. The general information regarding the commands and objects can be found in the S/38 Functional Reference Manual, GA21-9331.

The communications management operates on behalf of a controller (station) or CPU and the logical units (devices) attached to the station or CPU. The communications management performs the SNA functions necessary to complete a REQIO instruction (ie, path control, CPM.SEND, CPM.RCV, pacing, and portions of session control).

5.2.1 COMMUNICATIONS DEVICES SUPPORTED

5.2.1.1 Primary Support

The primary device management supports any communications device which uses SNA Fid3 transmission headers or GSD's version of Fid3 (T3). The T3 transmission header is defined in SNA.

5.2.1.2 Secondary Support

The secondary device management can attach to any primary communication which supports the following:

1. One physical Unit Type 2.
2. Multiple LUs and LU types on a single link. LU type one is supported as either 3770 emulation or 3287 SCS printer. LU type 2 is supported as a 3277 display, and LU type 3 is supported as one of the 328X series of printers.
3. Transmission Profile 3 for LU-LU session.
4. Function Manager Profile 3 for LU-LU session.
5. Presentation Class on SSCP.LU session is unformatted System Service using SCS. SSCP-LU and SSCP-PU sessions use transmission Profile 0 and FM Profile 1.
6. SSCP IDs within the System 38 domain must be unique.

5.2.2 COMMUNICATIONS DEVICE LOGICAL UNIT DESCRIPTION (LUD) OBJECT

All communications devices require a Logical Unit Description (LUD) object to be created for their support. These LUDs are of a LUD type '30' for which a Network Description (ND) object and Controller Description (CD) object are required for the LUD's attachment to System 38. All information necessary to create LUDs for each specific communications device will be supplied in the subsequent sections. That information which is common to all LUDs, such as name, creation options, forward pointers, type definitions, associated space, and etc, is defined by the Source/Sink architecture.

5.2.3 COMMUNICATIONS DEVICE ATTACHMENT

Only one communications object configuration exists for attachment of communications LUD objects to System 38 (see Figure 5.2.3). The LUD type '30' requires the creation of both a ND and CD object. The specific data required in the ND for a given line type is discussed in Section 3.3.1.1 for Primary and Section 3.3.1.2 for Secondary support. The specific data required in the CD will follow in subsequent sections.

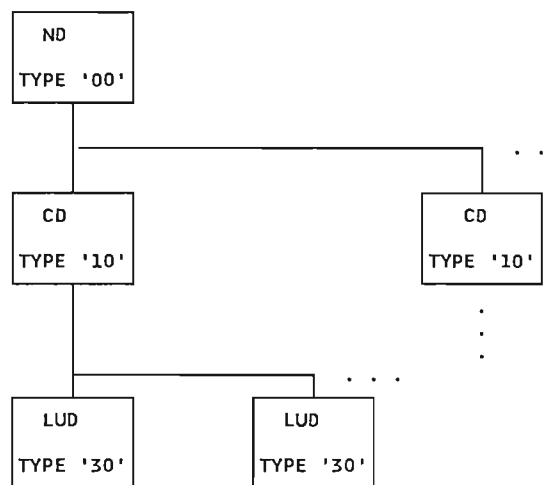


Figure 5.2.3 Communications Object Configuration--
SNA/SDLC

5.2.4 PROGRAMMING CONSIDERATIONS

Communication with a CPU, station, or device is accomplished through SNA paths.

Primary Support

An MSCP-PU path is activated when the CD is varied on, an MSCP-LU path is activated when the LUD is varied on, and an LU-LU path is activated when a MODLUD (activate) is executed.

Secondary Support

An SSCP-PU path is activated when the ND and CD are varied on and an ACTPU is received, an SSCP-LU path is activated when the LU is varied on and an ACTLU is received, and an LU-LU path is activated when a MODLUD (activate) is executed. To manage these SNA paths the device management supports the following MI commands.

MODND:	Vary On/Off Enable/Disable Manual Answer/Abandon Call Start Data Continue/Cancel
MODCD:	Vary On/Off Dial/Abandon Connection Continue/Cancel
MODLUD:	Vary On/Off Activate/Deactivate Suspend Quiesce Reset Continue/Cancel
REQIO:	Functions - Normal MSCP Control - Normal Continue

Prior to using any of these commands, the user must create the network describing the line-ND, the station(s)-CD, and the device(s)-LUD. This is done by using the following MI support code instructions:

CRTND - Create Network Descriptor
CRTCD - Create Controller Descriptor
CRTLUD - Create Logical Unit Descriptor

See the instruction sections for the template data needed to create the CD(s) and LUD(s) for the supported station(s) or device(s).

5.2.4.1 MI Commands

5.2.4.1.1 MODIFY ND

MODND (VARY ON/OFF)

These commands are used to activate or deactivate the primary or secondary communications line.

MODND (ENABLE/DISABLE)

These commands are used on switched communications lines to actually enable the line to accept incoming calls, outgoing calls or calls in either direction

based on the setting of the switched connection method field in the ND.

MODND (MANUAL ANSWER/ABANDON CALL)

These commands are used to synchronize the hardware adapter signals with operator actions for completing or discontinuing a switched manual answer connection. Specifically, this command indicates that the operator has established the connection and causes the MSCP to initialize the line.

MODND (START DATA)

This command indicates that the operator has manually placed the modem in Data Mode, and the line is now ready for Data Communications. The MSCP will send a connect-in SRM to the IOM causing the IOM to send Enable Switched connection.

MODND (CANCEL)

This instruction is used to suspend the reconnection and reuse of the communication line.

MODND (CONTINUE)

This instruction is used to enable (allow) the reuse of the line after an unrecoverable error has occurred.

5.2.4.1.2 MODIFY CD

MODCD (DIAL/ABANDON CONNECTION)

These commands are used to allow a station to be dialed manually or automatically or to be disconnected.

MODCD (VARY ON/OFF)

This command is used by device management to establish or break the communication path to the physical unit in the CPU or station represented by the CD.

MODCD (CANCEL)

This instruction is used to suspend the reconnection and reuse of the controller.

MODCD (CONTINUE)

This instruction is used to enable (allow) the reuse of the controller and request that contact be established after an unrecoverable error has occurred.

5.2.4.1.3 MODIFY LUD

MODLUD (VARY ON/OFF)

Primary

This command is used to establish or break the communication path from the MSCP to the LU.

Secondary

This command is used to establish or break the Communication Path from the LU to the SSCP. It also performs preliminary setup for the LU-LU path.

MODLUD (ACTIVATE/DEACTIVATE)

This command is used to establish or break the communication path from the System 38 LU to the CPU or station's LU. MODLUD (activate) is also used to activate the LU-LU path when it is in any one of the three inactive states (suspended, quiesced, or reset).

MODLUD (QUIESCE)

Once the device management receives this request, it will complete all REQIOs that are in progress or waiting on the internal LU queue. Upon completion of this command, the device management will come to a normal completion and all REQIO processing is discontinued until the path is reactivated with a MODLUD (activate) command.

The quiesce is completed with a rejected status in four situations. The first is that the unit is already in a terminating error mode upon receipt of the quiesce. The second is when the unit is in an ERP state upon receipt of the quiesce. The third is that the unit drops into the terminating error mode while trying to complete the quiesce. The fourth is when the quiesce cannot complete within the timeout value specified due to a long running REQIO in process. In these situations, the user must analyze the feedback record(s) on his return queue and perform the necessary recovery for the error situation.

MODLUD (RESET)

This command causes all REQIOs to be flushed back to the user's return queue, in an orderly fashion, with a feedback status indicating the flushed condition. The number of request descriptors processed will also be set in the feedback record. This command also places the path in an inactive state, which can be reactivated with a MODLUD (activate) command. All available unsolicited data is relinquished by this command.

It is possible for the reset to cause partial damage to the LUD. This would happen if the reset were issued with a timeout value specified which is shorter than the time needed to complete a transmit to hardware. For printers or displays using a copy to printer, this time may be as long as 60 seconds. Therefore, the time specified in the reset must be 60 seconds plus to assure the reset will complete normally.

For secondary, the feedback status and/or the number of request descriptors processed are understated when data has been transmitted to, but acknowledgement not received from, the far end; users wishing to resume normal REQIO processing should issue a MODLUD(SUSPEND) before a MODLUD(RESET) to prevent ensuing REQIO complications.

MODLUD (SUSPEND)

This command ensures the user that all REQIOs for this logical unit are in the suspended state. This means that all the REQIOs that have been started will be completed. The REQIOs that are completed will be placed on the return queue with the appropriate feedback code and number of RDs done.

The suspend may be completed with a reject status if the suspend cannot complete within the timeout value specified due to a long running REQIO in process.

Note: It is possible for MODLUD (suspend) to complete normally and the logical unit to be placed in terminating error mode. Therefore, it is recommended that the user check the queue for any feedback records indicating a terminating error condition.

MODLUD (SUSPEND, DEACTIVATE, AND ACTIVATE)

This combination of MODLUD commands can be executed to perform a logical unit 'Save' type of operation. This atomic set of commands will perform a suspend, reset, deactivate, and activate. Therefore, the user is guaranteed that all REQIOs are called back and placed on the user's queue and that the logical unit is in an active path state ready for a new set of REQIOs to process.

Note: A reset causes any available unsolicited data to be relinquished, as the device management has no way to give the data to the user.

MODLUD (CANCEL)

This instruction is used to suspend the device after an unrecoverable error.

MODLUD (CONTINUE)

This instruction is used to enable (allow) the reuse of the device after an unrecoverable error has occurred.

MODCD (UNIT SPECIFIC CONTENTS - RAM CONTENTS LIST RESET)

This command is used to reset an extension character in the RAM Contents List of each Kanji device attached to this controller. A subsequent output data stream containing the extension character will result in a VMC reference to the IGC table defining this character to insure that the latest image is portrayed correctly at the device.

5.2.4.1.4 REQIO

This command is used for two purposes. First, it is used to perform I/O on the various paths:

Primary

- A MSCP-To-Physical Unit
- B MSCP-TO-Logical Unit
- C Logical Unit-To-Logical Unit

Secondary

- A Physical Unit-To-SSCP
- B Logical Unit-To-SSCP
- C Logical Unit-To-Logical Unit

Second, the REQIO (continue) is used to return the logical unit to active path state after it has encountered a terminating error.

Refer to the Request I/O instruction for details on the REQIO command and its Source/Sink Request (SSR) object.

General REQIO Rules

REQIO (Normal)

1 Request Descriptors (RD)

- A A REQIO (normal) may contain all transmit Rds.
- B A REQIO (normal) may contain all receive Rds.
- C A REQIO (normal) may contain both transmit and receive Rds. All transmit Rds must occur prior to the receive Rds.
- D The write-up on Rds contain the detailed field description and usage.

2 SNA Flow:

The SNA Flow for a REQIO (normal) may be expedited, normal, or any. This is indicated in the SSR as defined later in this text.

REQIO (Receive Immediate)

1 Request Descriptor (RD)

- A A REQIO (Receive Immediate) is indicated by the first RD being a receive with the immediate bit set on.
- B A REQIO (receive immediate) may contain only receive Rds.
- C The write up on RDs contains the detailed field descriptions and usage.

2 SNA Flow:

The SNA Flow for a REQIO (Receive Immediate) may be expedited, normal or any. This is indicated in the SSR as defined later in this text.

REQIO (Transmit Immediate)

1 Request Descriptor (RD)

- A A REQIO (Transmit Immediate) contains only one RD which is encoded as a transmit immediate RD.
- B A REQIO (Transmit Immediate) will be processed prior to any SNA normal flow transmit that is already queued up for a LUD.

2 SNA Flow:

The SNA flow for a REQIO (Transmit Immediate) may be expedited or Normal. This is indicated in the SSR as defined later in this text.

Note: 1. A REQIO transmit or transmit/receive on the ANY flow defaults to a REQIO transmit only on the NORMAL flow.

Device Management Source/Sink Request (SSR) General

The SSR function bits have the following meanings for device management:

Bits 0-3 Same as defined in MI Vol III.

Bits 4-5 These bits define the SNA flow for which all the Request Descriptors (RDs) are to be processed on. The values and their meanings are:

00 and 10 - These combinations indicate that the RDs are to flow on the SNA normal flow.

01 - This combination indicates that the RDs are to flow on the SNA expedited flow.

11 - This combination indicates that the RDs are to flow on either the SNA expedited or normal flow (ie, it implements a receive any function).

Note: This bit setting is changed to '10'B (normal flow) if the first RD is a transmit RD.

Bits 6-7 Reserved (binary zero)

The SSR OPTIONAL POINTER field has the following meaning for the KANJI/Ideographic remote controller:

Bytes 0-3 SSD offset of RAM Contents List Save Area. When doing the SAVE part of the display SAVE/RESTORE function, the RAM Contents List is saved in the SSD by VMC so that it can be restored with the RESTORE part of the SAVE/RESTORE function. This save area in the SSD must be 2574 bytes in length.

Bytes 4-5 Flag bytes:

Bit 0 Clear Unit Indicator. Turned on for display output that erases or clears the entire screen, even if the same output also writes to the screen thereafter.

Bit 1 Extension Characters Processing Indicator. Turned on to enable the station IOM functions of scanning the IGC data for Extension Characters and managing the ideographic device RAM.

Bit 2 Printer Direct Output Indicator. Turned on to indicate that the Printer FM is doing direct output (as opposed so spooled), which causes the Station IOM to restore the output data to its original form at REQIO feedback time. (Data may be overlayed with RAM addresses during output.)

Bit 3 User defined data indicator. Turned on to indicate that the user (as opposed to CPF) has inserted device control characters into the data stream. Used by the Station IOM as an indication that the ideographic device RAM may be altered by the user.

Bits 4-15 Reserved

Bytes 0-5 are all set by CPF and passed to VMC as control parameters.

Bytes 6-15 Used internally by the Station IOM while processing the REQIO, but not passed through the machine interface.

Device Management Request Descriptor

This request descriptor (RD) is used for communications devices. In SNA terms, the RD contains information for the transmission header (TH) and the request/response header (RH). The RD also provides for the length and location of the request information unit (RIU) in the source/sink data area (SSD). Both transmit and receive RDs may be specified in the SSR but all of the transmit RDs must precede any receive RDs. The fields in the RD are described below:

BYTE

0	1-3	4-5	6-7	8-10	11	12-15
---	-----	-----	-----	------	----	-------

Where:

0 = RU Flow Type
 1 = Reserved
 2 = Request Unit Subcommands
 3 = Reserved
 4-5 = Sequence #
 6-7 = RU Length
 8-10 = Request Response Header
 11 = Reserved
 12-15 = RU Offset

Request/Response Unit Flow Type - Char(1):

Bit 0 of the RU flow type indicates whether this is a transmit or receive RD.

Bit 0 = 0 Transmit RD
 Bit 0 = 1 Receive RD

Bit 1 indicates whether the RD has been processed by the machine or is awaiting processing. The device management ensures that this bit is set to zero upon receipt of the REQIO. This bit may not be used by the user to cause the device management to skip the RD. The device management always assumes that all the RDs in the REQIO are to be processed.

In a terminating or non-terminating error situation, the RD completion count will point to the RD on which the error was discovered. This RD will be marked processed. The values are:

Bit 1 = 0 - not processed
 Bit 1 = 1 - processed

Bits 2-3 are reserved and must be binary zero

Bits 4 0-Normal I/O operation
 1-Immediate I/O operation
 This bit means transmit or receive immediate depending on the setting of bit 0.

Bits 5-7 are reserved and must be binary zero (Note bits 6-7 are used internally by the SIOM for Kanji devices).

Reserved - Char(1) - must be binary zeros (used internally by the SIOM for Kanji devices).

Request Unit Subcommands - Char(1) - This field is currently not used for this communications support. Only value '00'X may be specified, other values will be ignored.

Reserved - Char(1) - must be binary zeros.

Sequence Number Field - Bin (2) - The two byte binary sequence number is used by the machine to perform transmission control operations. For a transmit RD, the machine inserts the sequence number into the sequence number field of the FID2 header. For a receive RD, the machine inserts the received sequence number into the sequence field after the number has been checked for in sequence.

Primary

This field is not used by device management for it is not supported in SNA-0081 protocols.

Secondary

This field is used by device management for it is supported under physical unit Type 2.

Request/Response Unit Length - Bin (2) - For a transmit RD, this field contains the length of the output RU. A length of zero indicates there is no RU associated with this RD. For a receive RD, before it is processed, this field specifies the space available in the SSD for the RU. After the receive RD is processed, this field contains the length of the received RU. If a group of receive RDs is specified in the SSR, the space available for all of the RUs can be specified in the first RD of the group. The RU length field in the remaining RDs of the group is set to zero. When the RDs in the group are processed by the machine, the RU length and offset fields are updated to the length and offset of the received RUs. The SSR can have more than one group of receive RDs. The RUs for all RDs in the SSR must be located in the same SSD.

Request/Response Header - Char(3) - These three bytes contain the information for the request/response header (RH). For a send RD, the information for the outbound RH is supplied to the machine in this field. For a receive RD, the

information from the received RH is inserted in this field when the RD is processed by the machine. All unused bits are identified as reserved and must be set to zero.

Byte 0 of the Request Header:

Bit 0 = 0 indicates this RU is an SNA request. In SNA, the terms request and response have precise definitions not to be confused with commands or replies.

Bits 1-2 are used to identify which of the four types of RU are being processed. The combinations of bits and their meanings are:

- 00 - Function Manager Data (FMD)
- 01 - Network Control
- 10 - Data Flow Control
- 11 - Session Control

Bit 3 is reserved (binary zero).

Bit 4 indicates which of the formats is used in the associated RU. The use of formats is session and RU type dependent (see SNA 0081 for Primary and SNA 0085 for Secondary). One use of this bit is to indicate the presence of an FM header in the RU.

Bit 5 = 0 indicates a valid request.

Bit 5 = 1 indicates the first four bytes of the RU are sense data for Exception Requests. Sense data must always be included on a response that indicates an error condition.

Bits 6-7 indicate which element of a chain of RUs is being sent. The bit settings are:

- 00 - Middle of chain
- 01 - Last of chain
- 10 - First of chain
- 11 - Only in chain

Byte 1 of the Request Header:

Bits 0-2-3 - These three bits are used in combination to specify the type of response required. Bit 0 is always one (except IPRs) and Bit 2 is always zero for SNA 0081 implementation. If Bit 3 is zero, a definite response must be sent. If Bit 3 is one (exception response mode), a negative response is sent only if an error is encountered, otherwise no response is sent.

Bit 1 is reserved (binary zero).

Bits 4-6 are reserved (binary zero).

Bit 7 - This bit specifies pacing control. It may be specified as zero. The device management within the machine will ensure

that it contains the correct setting when the request header is transmitted to the device.

Byte 2 of the Request Header:

Bits 0-1 - These bits are used for bracket control. Bracket use is session dependent. Bit 0 set to binary one indicates the beginning of a bracket. Bit 1 set to binary one indicates the end of a bracket.

Bit 2 - This bit, a change direction indicator, is used in a half duplex environment to control the orderly transmission of messages.

Bit 2 = 0 means do not change direction.

Bit 2 = 1 means change direction.

Bit 3 - Reserved (binary zero)

Bit 4 - The code selection indicator is used to allow the sender to specify that a previously agreed to alternate code is used in this RU.

Bits 5-7 are reserved (binary zero)

Byte 0 of the Response Header:

Bit 0 = 1 indicates this RU is an SNA Response.

Bits 1-2 are used to identify which of the four types of RU are being processed.

- 00 - Function Manager Data (FMD)
- 01 - Network Control
- 10 - Data Flow Control
- 11 - Session Control

Bit 3 is reserved (Binary Zero).

Bit 4 indicates which of the formats is used in the associated RU. The use of the formats is session and RU type dependent. (See SNA 0081 for primary and SNA 0085 for secondary.)

Bit 5 = 0 indicates that no sense data is included.

Bit 5 = 1 indicates that the first four bytes of the RU contains an SNA sense data.

Bits 6-7 indicate which elements of a chain of RUs is being received. The bit settings are:

- 00 - middle of chain
- 01 - last of chain
- 10 - first of chain
- 11 - only in chain

Byte 1 of Response Header:

Bit 0 is the same as the corresponding Request Header bit.

Bit 1 reserved (binary zero).

Bit 2 the same as the corresponding Request Header bit.

Bit 3 = 0 indicates a positive response.

Bit 3 = 1 indicates a negative response.

Bits 4-6 reserved (binary zero).

Bit 7 indicates a pacing response from the terminal.

Byte 2 of Response Header:

All of Byte 2 is reserved (binary zero).

Reserved Char (1) - Always set to binary zeros.

Request/Response Unit Offset - Bin(4) - The four byte RU offset is a displacement, in bytes, to the beginning of an RU from the beginning of the SSD space. An RU associated with a specific RD can be located by displacing into the SSD space an amount equivalent to the RU offset. The RU offset for a receive RD is updated by the machine if the RU length in the RD is specified as zero (ie, the RD is designated as a part of an RD group).

Source/Sink Data Contents - Normal REQIO.

The SSD for the Device Management RDs contains RUs as defined by the RDs location in the SSR. One RD defines one RU. The location of the RU within the SSD is determined by the RU offset field in the RD. For transmit RDs, the offset must be supplied to the machine in the RD. For receive RDs, the offset can be supplied for each RD or the offset can be supplied for the first RD of a group and the machine determines the offset for each subsequent RD in the group based on the length of the received RU. A receive RD is considered a member of a group if its RU length is zero. More than one group of receive RDs can be specified in an SSR but all of the RUs for those RDs must be located in one SSD.

RU Contents

In general the RU (request/response unit) contents are not described for devices (Logical Units) attached through communications device management since the LU layer of SNA support is generally above the machine interface and as such the user and the end device have responsibility for that level of protocol while the machine provides the carrier functions (SNA transmission subsystem).

For 5294 an exception to this philosophy exists in order that the machine is able to provide the downloading of program data to the 5294 controller. The controller will request a download on its response (RU) to the first BIND (SNA) command which is issued (assuming that the user has specified this appropriately in the BIND command) and the machine will monitor this RU to look for this indicator and provide the download function if requested. It is

the users responsibility to control this BIND function appropriately as indicated in the 5294 specifications.

5.2.4.1.5 SYNCHRONOUS SOURCE/SINK REQUEST (SSR)

The Synchronous REQIO has the same SSR template and field definitions as the Asynchronous REQIO. The only exceptions to the Asynchronous definitions and operations are as follows.

- The Control Field will indicate a synchronous REQIO via a '20'X encoded in it.
- THE PROCESS ISSUING THE REQIO WILL BE SUSPENDED UNTIL THE OPERATION IS COMPLETE IN THE SAME MANNER AS THE MODIFY INSTRUCTIONS.
- The timer value in the SSR template will be used to time the REQIO operation. This will guarantee that the process will not be dormant forever.
- The Synchronous REQIO operation is short in execution time.
- The SSR will be allowed only one RD.
- No feedback record will be returned.

5.2.4.1.6 SYNCHRONOUS REQUEST DESCRIPTOR (RD)

The Synchronous RD has the same layout and field definitions as all other RDs.

The RD functions are restricted to single operations.

'04'X SET PCS ADDRESS: This command causes the PCS address of the sending process to be saved by the SIOM. This enables the SIOM to signal the LU-LU normal flow unsolicited data event (000B 05 06) on a process dependent basis rather than machine wide. The event will continue to be signaled this way until a MODLUD(RESET) is received.

'08'X RETURN REQIO: This command causes all outstanding REQIO'S for this LUD to be flushed back to the user's return queue with status indicating that a RETURN REQIO was executed.

5.2.4.2 Feedback Record

The device management supports the feedback record for the Request I/O instruction. The feedback information for the device management consists of the error summary field and the number of RDs processed. All other status fields are not used by communications.

The following table gives the error conditions, the severity code, and recovery procedures. The severity codes are returned in the error summary field.

NOTE: All feedback codes may have the MSCP bit on in the function portion of the Error Summary field. This bit is turned on only if the REQIO

function field indicates an MSCP REQIO (eg, normal completion for an MSCP REQIO is '0800'X instead of '0000'X).

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
0000	N/A	N/A	Normal completion	No recovery necessary.
0008	N/A	N/A	REQIO continue normal completion (Terminating error reset.)	No recovery necessary.
0018	N/A	N/A	REQIO Receive Immediate complete with no unsolicited data received on indicated SNA flow.	No recovery necessary.
0044	N/A	N/A	Source/Sink data area too small -The current request has an SSD remaining length field that is smaller than the RU received from the station.	1. Handle this feedback as if it were an event for unsolicited data. 2. Send the Station IOM a REQIO to obtain the data. 3. If data is not desired, issue a Deactivate Resource REQIO. NOTE: This also recalls all outstanding Reqio's for this Conversation and purges all unsolicited data. If data is purged, a negative response is sent.
4009	N/A	N/A	REQIO partially complete due to the MODLUD (Reset), MODLUD (Deactivate), or MODLUD (Vary Off) command. Some RD's were processed.	Continue performing the cleanup process.
400A	N/A	N/A	REQIO complete due to the execution of a MODLUD (Reset), MODLUD (Deactivate), or MODLUD (Vary Off) command. No RD's completed.	Continue performing the cleanup process.
4013	N/A	N/A	Negotiable Bind Response received which was not long enough to contain pacing information.	Do not allow the LU-LU session to go to the bound state.
4024	N/A	N/A	REQIO transmit immediate error (LU1 only).	1. REQIO Transmit Immediate was attempted with a frame that was not valid to be sent at this time. 2. Reissue at a later time or use the non-immediate REQIO form.
4029	N/A	N/A	Pacing error in the bind response. The terminal has attempted to override the host's pacing parameters.	1. Vary the LUD off. 2. The problem is probably a microcode problem in the terminal.
4031	N/A	N/A	Object not Online; Invalid State Exception signaled. (LU1 only).	Vary the object on.
4037	N/A	N/A	Request I/O complete due to the execution of a synchronous Return Reqio. (LU1 only)	No recovery necessary.
4088	N/A	N/A	Invalid RD sequence. A sequence of transmit/ receive/transmit is not allowed in a REQIO operation	Split the REQIO operation into two REQIO operations. First one does transmit/ receive. Second one does the remaining transmits. NOTE: Station IOM REQIOs must be of the following variety: Transmit only Transmit & Receive

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
				Receive only
702C	D010 D012 D013 D014 D015 D016 D017 D018	N/A	KANJI/IGC data stream error. Specific information is given in the Device Dependent Status area. (See Table 1 below.)	1. Inform the user who is responsible for the content of the data. 2. The data is sent out anyway, as if normal, to display or print whatever the device can handle.
C00B	N/A	N/A	IOM partial damage. CD object partially damaged.	1. Vary Off all LUD's and the CD. 2. Correct MI User problem (SSD should not be destroyed). 3. Vary on LUD's and the CD.
C020	N/A	N/A	LUD failure. The LU session was taken down due to some host problem (LU1 only).	1. Deactivate and Vary Off the LUD. 2. The specific logical unit failure reason is defined in the LUD failure event (000B 08 01) and in the hardware error code defined here.
C028	N/A	N/A	Invalid Information Unit: Invalid session control function for this LU session (LU1 only).	1. Issue a REQIO Continue to reset the terminating error condition. 2. Continue to cleanup session.
C041	N/A	N/A	SSD destroyed.	Provide a proper SSD, perform any higher level recovery which is necessary since data may have been lost, then reissue the REQIO and issue a REQIO continue.
C045	N/A	N/A	REQIO contains a transmit RD which specifies an RU of size larger than the maximum RU size for this LU-LU session.	Set the correct RU size in the RD. Reissue the REQIO after issuing a REQIO continue.
C054	N/A	N/A	REQIO for LU-LU session attempted prior to session being bound.	1. Issue a REQIO continue to reset the terminating error condition. 2. Continue to cleanup session.
C055	N/A	N/A	START DATA TRAFFIC reset: REQIO for LU-LU session was attempted and DATA TRAFFIC state machine not active (LU1 only).	1. Issue a REQIO Continue to reset the terminating error condition. 2. Continue to cleanup session.
C084	N/A	N/A	REQIO has an Invalid SSD pointer, SSD pointer cannot be zero if the data length is not zero.	1. Issue a REQIO Continue to reset the terminating error. 1. Correct either the SSD pointer or the data length field. 2. Reissue the REQIO.

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
E020	8000	A240 A260	Device failure: - Unexpected DACTLU - Unexpected ACTLU	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the LUD failure event (000B 08 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0001	808B 8103 81E3 8204 84E2 E2C4 8107 8137	Link failure: IBM hardware or hardware microcode problem (HMC or IOC) - Channel error - Post event - IOC/CA parity error - DTR inactive or DTR dropped - Adapter interrupt request timeout - RTS inactive or RTS dropped - Invalid BSTAT - Read sense failure	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0002	8049 80AC 8360 8380 F660	Link failure: IBM software problem (not HMC or IOC) - Operation program error - IOC command reject - Line not initialized - SW line disc. timeout (Pri.) - MS buffer overflow	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0003	8401 F441 F481	Link failure: Data overrun, data underrun - Channel disconnect at IOC - Data overrun or channel disconnect - Data underrun or channel disconnect	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0004	8224 E324	Link failure: Local modem problem - DSR timeout or DSR dropped - CTS timeout or CTS dropped	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
E021	0008	F705	Link failure: Idle state detected on the line - Idle state detected	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0009	F7A5 F517 F527 A380	Link failure: Line, far end hardware, or local hardware problem - Non-productive receive timeout (Pri.) - SDLC transmit sequence error - SDLC receive sequence error - SW. line disconnect timeout (Sec.)	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000A	F4C2	Link failure: Adapter overrun or underrun - Adapter overrun or adapter underrun	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000B	96A5 F7C5 9227 9237 F507	Link failure: Far end problem - Request to transmit timeout (RLSD N seconds) - Frame aborted - SDLC out of range sequence number - Wrong SDLC address (Pri.) - Unrecognizable SDLC control field	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000C	F805	Link failure: Redundancy check (CRC) error - Redundancy check error (CRC)	1. Issue a MODLUD (reset) to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
E021	000D	9217	Link failure: Far end has entered Disconnect Mode - SDLC Disconnect Mode received (Pri.)	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000F	9207	Link failure: SDLC Frame Reject - SDLC Frame Reject received (Pri.)	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0002	8380 F660	Peer failure: IBM software problem (not HMC or IOC) - Sw. line disc. timeout (Pri.) - MS buffer overflow	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0003	8401 F441 F481	Peer failure: Data overrun, data underrun - Channel disconnect at IOC - Data overrun or channel disconnect - Data underrun or channel disconnect	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0004	8224	Peer failure: Local modem problem - DSR timeout or DSR dropped	1. Issue a MODLUD Reset to reset the terminating error and return all REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
E022	0008	F705	Peer failure: Idle state detected on the line - Idle state detected	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0009	F7A5 F517 F527	Peer failure: Line, far end hardware, or local hardware problem - Non-productive receive timeout (Pri.) - SDLC transmit sequence error - SDLC receive sequence error	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	000B	96A5 F7C5 9227 9237 F507 A220 A200 A210 A230 A250	Peer failure: Far end problem - Request to transmit timeout (RLSD N seconds) - Frame aborted - SDLC out of range sequence number - Wrong SDLC address (Pri.) - Unrecognizable SDLC control field The following apply to SDLC secondary only: - SDLC frame reject - Unexpected SDLC SNRM - Unexpected SDLC Disconnect - Unexpected DACTPU - Unexpected (2nd cold) ACTPU	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	000C	F805	Peer failure: Redundancy check (CRC) error - Redundancy check error (CRC)	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	000D	9217	Peer failure: Far end has entered Disconnect Mode - SDLC Disconnect Mode received (Pri.)	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE I: LU7 and LU1 FEEDBACK CODES

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
E022	000F	9207	Peer failure: SDLC Frame Reject - SDLC Frame Reject received (Pri.)	1. Issue a MODLUD Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
F02C	D019 D020 D021	D019 D020 D021	KANJI/IGC interface error. Specific information is given in the Device Dependent Status area. (See Table 1 below.)	1. Correct the error. Re-issue the REQIO. 2. The error is also recorded in the error log.

Note: Terminating error severity requires the user to use a REQIO (continue) command to bring the path back to an active path state or a MODLUD (reset, activate) to clear the path for normal traffic.

Table 1:

Format of the Feedback Record for the KANJI/Ideographic Work Station Controller when the error summary field is either '702C'X or 'F02C'X:

Bytes 00-15 S/S Request Address (No change)
 Bytes 16-17 Request ID (No change)
 Bytes 18-19 Error Summary '702C'X or 'F02C'X
 Bytes 20-21 RD Number (No change)
 Bytes 22-23 RIU Segment Count (No change)
 Bytes 24-63 Device Dependent Area
 Bytes 24-25 Binary zeros (No change)
 Bytes 26-27 Binary zeros (No change)
 Bytes 28-35 Binary zeros (No change)
 Bytes 36-37 Binary zeros (No change)
 Bytes 38-63 Device Defined Data
 Bytes 38-39 Error Code (See table below)
 Bytes 40-41 Sub-category (See table below)
 Bytes 42-43 Extension (See table below)
 Character or
 RAM Address
 Bytes 44-47 Data offset (See table below)
 Bytes 48-63 Reserved

BYTES: 18-19 38-39

40-41

42-43

44-47

ERROR SUMMARY	ERROR CODE	ERROR DESCRIPTION	SUB-CATEGORY	EX. CHAR/ RAM @	DATA OFFSET
702C	D010	True RAM Full	0001: In Write Data	Ex. Char.	Data Offset
			0002: In Read Data	Ex. Char.	Data Offset
702C	D012	Invalid Character in Input Data Stream	0001: Unrecognizable char - .LT X'40'	0000	Data Offset
			0002: Attribute found in IGC mode	0000	Data Offset
			0003: Not READ MDT cmd and X'11' found, or READ MDT cmd and X'11' in IGC field	0000	Data Offset
			0004: SO in IGC field	0000	Data Offset
			0005: SI in ANK field	0000	Data Offset
			0006: Odd number of nulls in IGC field	0000	Data Offset
			0007: Odd number of X'1C's in IGC field	0000	Data Offset
702C	D013	Undefined Extension Character on Output	0001: In Display Data	Ex. Char.	Data Offset
			0002: In Printer Data	Ex. Char.	Data Offset
			0003: In Restore Data	Ex. Char.	Data Offset
702C	D014	Invalid IGC Character on Output	0001: Invalid Point	Ex. Char.	Data Offset
			0002: Invalid Ward	Ex. Char.	Data Offset
702C	D015	Unmatched SO on Input	0001: No SI to match SO	0000	00000000
702C	D016	Unmatched SO on Output	0001: Write to display	0000	00000000
			0002: Write Error Code	0000	00000000
702C	D017	Invalid 5250 Display Control Character on Output	0001: Unrecognizable Char - .LT X'40' in IGC field	0000	Data Offset
			0002: Attribute found in IGC field	0000	Data Offset
			0003: X'04' - not found when expected X'04XX' - XX not recognized command, or other invalid not listed below	0000	Data Offset
			0004: X'04', then end of data before end of cmd	0000	Data Offset

BYTES: 18-19 38-39

40-41

42-43

44-47

ERROR SUMMARY	ERROR CODE	ERROR DESCRIPTION	SUB-CATEGORY	EX. CHAR/ RAM @	DATA OFFSET
			0005: SO in IGC field	0000	Data Offset
			0006: SI in ANK field	0000	Data Offset
			0007: Odd number of nulls in IGC field	0000	Data Offset
			0008: Invalid syntax in Start of Field order	0000	Data Offset
			0009: Error in ECSCAN	0000	Data Offset
			0010: RESTORE cmd encountered with another command	0000	Data Offset
			0011: Odd number of X'1C's in IGC field	0000	Data Offset
702C	D018	Invalid Printer Control Character	0001: Invalid SCS control character	0000	Data Offset
			0002: Error in ECSCAN	0000	Data Offset
F02C	D019	Invalid RAM Address	0001: Input RAM address is out of hardware range	RAM@	Data Offset
			0002: Input RAM address maps to RCL entry with no Ex. Char.	RAM@	Data Offset
F02C	D020	RAM Contents List Missing in REQIO Save Area (RESTORE side of SAVE/RESTORE)	0001: No RCL in Save Area 0002: No RCL save area allocated	0000	00000000
F02C	D021	REQIO Save Area Invalid (SAVE side of SAVE/RESTORE)	0001: No RCL Save area allocated	0000	00000000

Note: Data Offset is SSD offset if output, and input buffer offset if input.

5.2.4.3 Events Raised By Communications Support

5.2.4.3.1 ND EVENTS

ND Connection Failure : (000E 04 01, 03)

Subtype 01, XID or SSCP-ID failure, is signaled by the MSCP component whenever switched line connection cannot be established to the communications station. It is signaled for primary SDLC XID failures and is signaled for secondary SSCP-ID failures. Refer to MSCP Section 5.1.2 and Event Section 8.1.3 for details.

Subtype 03, Disconnect failure, is signaled for secondary support whenever disconnect is received from the far end primary station prior to ACTPU being received.

ND Line Failure : (000E 05 01,02)

Subtype 01: Inoperative

This event is signaled by communications management (line IOM component) whenever an unrecoverable line error has occurred. The event related data provides a 2-byte error code, a timestamp, and OU number. Refer to Section 5.3 for the event error codes and the recovery actions for each of these cases. See also CD Failure Event in the next section.

Subtype 02: SNA Protocol Violation (Secondary Only)

This event is signaled by communications management whenever an SNA RU is received prior to Activate Physical Unit being processed. The event related data provides a 2 byte error code, a timestamp, and OU number. Refer to Section 5.3 for a description of the error log entry which is also recorded with the same timestamp value. Communications management does not force varying off of this ND as a part of the recovery action for this subtype. Refer also to Section 5.2.4.3.4 for error code association between this event and CD Failure (protocol violation) event.

5.2.4.3.2 CD EVENTS

CD Contact Event : (0004 04 01,02,03)

Subtype 01: Contact successful

Subtype 02: Contact unsuccessful

<u>Reason Code</u>	<u>Reason</u>
0002	Dial unsuccessful
0003	XID or SSCP-ID mismatch
0004	ND not in candidate list
0005	CD not varied on
000D	LUI Disconnect before ACTPU received from far end
000E	Primary SDLC received RD response in reply to XID or SNRM
000F	Primary SDLC received a station address from far end that does not match CD, but XID does match

0010	CD (on answer) Primary SDLC received a station address from far end that does not match CD, but XID does match CD (for dial)
0011	Negative response to ACTPU (3274 controller)
B104	Primary SDLC received excess number of negotiable XID responses as replies to XID commands, far end refuses to assume secondary SDLC role
B106	SDLE received XID with error control vector.
B108	Received XID with invalid data in I-frame, S/38 does not accept data in XID received

Subtype 03: Loss of contact (disconnect from primary)

<u>Reason Code</u>	<u>Reason</u>
0001	Disconnect (DISC or RD) received from SDLC remote

These event subtypes are signaled by the MSCP upon completion of the VARY ON processing for the communication station whether it is on a leased or switched network. See MSCP Section 5.1.2 and Event Section 8.1.1 for details.

CD Failure Event : (0004 05 01,02,03)

Subtype 01: Inoperative

This subtype is signaled by communications management (line IOM component) whenever an unrecoverable station error has occurred. The event related data provides a 2-byte error code, a timestamp, and OU number. Refer to Section 5.3 for the event error codes and the recovery actions for each of these cases. Note that the set of error codes for the CD failure event, subtype 01, is common to those of the ND failure event listed in the previous section. Although not all of these codes can come up in both cases (ie, line failure versus station failure), it is not always possible to identify which component has actually failed, so recovery actions must include both possibilities.

Subtype 02: Protocol Violation Detected

This subtype is signaled by communications management (Station IOM component) whenever an SNA path error has been detected. Event related data includes a 2-byte error code, a timestamp, and the OU number. Refer to Section 5.3 for the error log entries, which are also recorded with the same timestamp value, and for further recovery actions. Communications management does not force varying off of this CD as part of the recovery action for this subtype. If the error can be corrected, the CD and LUDs below it remain operational. Refer also to Section 5.2.4.3.4 for error code association between this event and ND Failure (protocol violation) event.

Subtype 03: SSCP to PU Session Inactive (CD Unavailable)

This subtype is signaled by the MSCP to indicate that the physical unit has been deactivated via an SNA DACTPU command. This is the normal deactivation case.

CD Manual Intervention Event: : (0004 06 01 03)

Subtype 01: CD Manual Intervention

This event is signaled by the MSCP to request operator assistance in making a switched line connection whenever a manually dialed communication facility is installed.

Subtype 03: Switched Intervention

- This event is signaled by the MSCP for the following conditions:
 - When the first Activate Resource REQIO to activate the resource is received for any LUD, in a VARIED ON PENDING or higher state with the Recovery Activation status of CONTINUE, attached to a VARIED ON PENDING CD with the Recovery Activation status area indicating CONTINUE.
 - When the MODIFY CD Continue instruction is issued and an Activate Resource REQIO is present for any LUD attached to the CD.
 - When the MODIFY CD Abandon Connection is issued and an Activate Resource REQIO is present for any LUD attached to the CD. NOTE: This event will not be signaled when the only attached LUD(s) with Activate Resource REQIOs pending have the Recovery Activation Status of INOPERATIVE PENDING indicated.

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

5.2.4.3.3 LUD EVENTS

Supervisory Services Request Event: (000B 04 01, 02)

This event is signaled by the MSCP component whenever SNA FM data requests are received on the SSCP-LU flow. Refer to MSCP Section 5.1.2 for details. For Remote 3270 support this event is signaled directly by the PSIOM.

Unsolicited Message Event: (000B 05 01,02,03,05,06)

This event indicates that unsolicited data is available for this LU. The data can only be retrieved by issuing a REQIO instruction.

Subtype: 01. The data is on the expedited SNA flow.

02. The data is on the normal SNA flow.

Primary Support

This event is raised only for the first unsolicited frame received and any time there are not enough receive RDs available.

Secondary Support

This event is raised only for an RU with Begin Chain indicated and no receive RDs available.

LUD Contact Event: (000B 06 01,02)

This event is signaled by the MSCP upon completion of the VARY ON processing for this logical unit. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details.

Subtype: 01. LUD contact successful.
02. LUD contact unsuccessful.

Subtype 01 is also signaled for secondary support where an ACTLU has been received from primary with no session established for this LUD.

LUD Failure : (000B, 08 01,02,03)

Subtype 01: Signaled on behalf of communications devices only for secondary support cases where primary has indicated the following abnormal conditions:

<u>Error-Code</u>	<u>Situation</u>
A240	DACTLU received with LU session active
A260	SECOND ACTLU received with no ERP (cold start)

No additional event related data except the above error code will be supplied for these cases.

Subtype 02: LUD Device Not Available

This subtype is signaled by the MSCP when an SNA LUSTAT is received on the MSCP-LU session indicating that the device is not available. The event data will contain the LUD object pointer and the LUSTAT code.

Subtype 03: SSCP to LU Session Inactive

This subtype is signaled by the MSCP component whenever an SNA/SDLC state machine change has occurred that requires the SNA FSMs to be reset. The following case has been defined:

<u>Error Code</u>	<u>Situation</u>
'0001'X	DACTLU received - no session

REQIO Complete Event: (000B 09 01)

This event indicates that the REQIO asynchronous processing has been completed. It is signaled only if the user requests it.

Request I/O Response Queue Destroyed Event :
(000B 0A 01)

This LUD event indicates that the return queue specified in the REQIO instruction has been destroyed. Note: This LU path is also placed in terminating error mode.

5.2.4.3.4 ERROR CODE ASSOCIATION WITH SNA PROTOCOL VIOLATION EVENTS

Event-> Error	000E 0502 (Secondary Line)	0004 0502 (Secondary Station)	000E 0502 Primary Line	0004 0502 Primary Station
0801		X		X
0806		X		
0809		X		
080C		X		
0815		X		
081D				
0821		X		
1003		X		
2005		X		
4005	X	X		X
4008				X
8004		X		X
8005	X	X		
8006	X	X		X
8007	X	X		X
8008	X			
8009		X		
800B	X	X		X

5.2.4.4 Exception Codes Signaled for Communications Devices

Refer to Section 5.3.3.8 for a list of these exceptions.

5.2.5 OBJECT CREATION DATA FOR SUPPORTED DEVICES

This section defines the data needed to create the objects necessary to attach a specific device to the System/38. There is a section for each device supported.

5.2.5.1 Remote Work Stations

5.2.5.1.1 CD TEMPLATE DATA FOR REMOTE CONTROL UNITS - 5251, 3274, 5294

Field Name	Description	Length	Data
CD Type	Controller descriptor that is attached to an 'ND'.	Char(2)	'10'
Unit Type	- The controllers IBM product number	Char(4)	'5251' '3274' '5294'
Model Number	- The controllers model number	Char(4)	'0002' - Model 2 - 5251 with 960 character screen '0012' - Model 12 - 5251 with 1920 character screen '0001' - for 5294 ' K01' - for 5294 with remote KANJI ' ' - (4 blanks) for 3274
Physical Address	Controllers complete network Address	Char(8)	
• Reserved	These four bytes always zero	Bin(4)	'00000000'X
• Station's line Address		Bin(2)	--
- Station's Line address	Station's Line Address: CE will supply	Bin(2)	Any value from '0001'X to '00FE'X
• Operational Unit #(OU#)	- OU # of the corresponding ND if a leased line - Zero if a switched line	Bin(2)	CE will supply '0000'X
Power Control	Not used	Char(2)	'0000'X
Station Control Information	This data describes the station and its operating modes	Char(32)	
• XID Information	Layout directly from SNA	Char(21)	
- XID format	Indicates usage of the variable length format	Bit(4)	'0001'B
- Physical Unit Type (PU)	PU Type 1 which implies FID3 headers for transmission	Bit(4)	'0001'B
- XID Information Length	Length of this variable format	Bit(8)	'14'X
- Station's Name		Char(4)	
Block #	Manufacturing assigned product number	Bit(12)	'020'X for 5251 controllers '045'X for 5294 controllers '001'X - '0FE'X for 3274 'nnnnn'X
Specific ID	User assigned id-used to ensure unique ids on a line	Bit(20)	
- Reserved		Char(2)	'0000'X
- Configuration flags	-This specifies HDX secondary support	Bit(8)	'00'X
- PU characteristics	This indicates no segments are allowed and PU can	Bit(8)	'B0'X - for 5251 '30'X - for 5294

- Maximum Length received	receive RUs from SSCP This field specifies the maximum length for the basic path information unit (PIU=TH RH RU)	Bin(2)	'0105'X for 5251 or 5294 '0109'X for 3274
- Reserved		Char(4)	'00000000'X
- Frames Limit	SDLC maxout count: number frames that can be transmitted to this remote station before acknowledgment is needed. Note: The device management task always uses this field as it is presented by the station at execution time	Bit(8)	'0003'X if only the basic 5251-12 (ie, one display). '0007'X if 5251-12 has the 'Remote Cluster Feature', RCF
- Reserved		Char(4)	'00000000'X
• Station Definition	-Defines the type of connection and role played by the station.	Char(1)	
- SDLC Link		Bit(2)	B'10'
- Link Type		Bit(1)	B'0' - Nonswitched B'1' - Switched
- Stations Role		Bit(1)	B'0' - Secondary
- Switched Network Backup Feature		Bit(1)	B'0' - No backup B'1' - Switched backup
- Data Rate Selection Feature		Bit(1)	B'0' - No Modem feature B'1' - Yes, has feature
• Reserved		Char(2)	'0000'X
• Path Information Unit Type	SNA transmission header (TH) that station uses	Bin(2)	'0003'X: FID3 as T3 SNA protocol
• Reserved		Char(6)	Binary zeros
Selected Modes	Defines user selectable Features -Indicates station is to run in a leased environment -Indicates that station is to run in a switched network backup environment -SNBU must be specified in the Station definition field	Char(2)	'0000'X '1000'X
Delayed Contact Control	Delayed Station Contact Control	Char(2)	'0000'X not in effect '0100'X - in effect
Activate Physical Unit Data	N/A for 5251 or 5294 For 3274: Indicates ACTPU data to be transmitted from S/38 (primary) to 3274 (secondary).	Char(16)	All Binary Zeros for 5251 or 5294 For 3274:
• ACTPU Required		Char(1)	'01'X
• Request Code		Char(1)	'11'X
• Type		Char(1)	'01'X Cold
• Activation			'02'X ERP
• Profiles	Function Manager Profile 0 Transmission Profile 1	Char(1)	'01'X
• SSCP-ID	PU Type 2 Installation SSCP-ID	Char(6) Char(1) Char(5)	'05'X '0000000000'X

Dial Digits	Phone number if a switched station		
• Reserved		Char(6)	All binary zeros
• Length	- Number of dial digits	Bin(2)	
• Digits	-Actual phone number. May only contain digits 0-9 or separator (SEP) character X'7D' or End of Number (EON) character X'5C'. These two special patterns are represented by the apostrophe and asterisk keys on EBCDIC keyboards.	Char(16)	
• Reserved		Char(8)	Binary zero
Specific Characteristics	N/A	Bin(2)	'0000'X
XID Information Area	Work area used for XID data received from terminal		
• Length of XID Data		Bin(2)	'0014'X
• XID Data	Area to hold station's execution time XID data	Char(20)	Ignored at create time

For non-Kanji Controller:

Unit Specific Data Area	- Length of unit specific area	Bin(2)	'0002'X
	- Length of modifiable area	Bin(2)	'0002'X
Unit Specific Contents Area	- Reserved	Bin(2)	'0000'X

For Kanji Controller (Unit type '5294' Model Number '0001'):

Unit Specific Data Area	- Length of unit specific area	Bin(2)	'0008'X
	- Length of modifiable area	Bin(2)	'0008'X
Unit Specific Contents Area	- Reserved	Bin(2)	'0000'X

Character Generation
Utility (CGU) update
parameters

Bit(48)*

Options

Extension Character Ward
Extension Character Point
Extension Character Size

Bit(1)
Bit(15)
Bit(8)
Bit(8)
Bit(16)

'1'B - CGU update
Reserved
'56'X thru '7F'X
'41'X thru 'FE'X
'0012'X - 18X18 Dot Matrix
'0018'X - 24X24 Dot Matrix

* CGU Update Parameters are used only on the Modify CD Unit Specific Contents command (operand 3 of MODCD command = 4010). On all other MODCD commands, the CGU update parameters are not used and should be set to zeros.

5.2.5.1.2 LUD TEMPLATE DATA FOR 5251,5555,5291,5292,3180,3277
3278, or 3279 Displays

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	Logical unit that is attached to a CD	Char(2)	'30'
Device Type	-The devices IBM product number	Char(4)	'5251' or '5291' or '5292' or '5555' or '3180' or '3277' or '3278' or '3279'
Model Number	-The devices model number	Char(4)	'0001' for 960 character screen 5251 Note - This device (5251-0001) is not supported for attachment to 5294 controllers. '0011' for 1920 character screen 5251 'B01' for 5555 '0001' for 5291 '0001' for 5292-1 '0002' for 5292-2 '0002' for 3180 Note - This device (3180-0002) is attachable only to 5294 controllers. ' ' (4 blanks) for 3277, 3278 or 3279
Physical Address	Logical units complete network address	Char(8)	
• Reserved	These two bytes always zero	Bin(2)	'0000'X
• LU Address (DAF)	Destination address of the display head (LSID) Select one of the following: -Address of 1st display -Address of displays hung off of remote cluster feature	Bin(2)	'0000'X '0002'X to '0009'X for 52XX if attached to 5251-12 controller '0002'X to '0021'X for 327X devices For devices attached to 5294: '0000'X to '0006'X on Port 0 '0007'X to '000D'X on Port 1 '000E'X to '0014'X on Port 2 '0015'X to '001B'X on Port 3
• Station Line Address	Same address as in CD this LU attaches to	Bin(2)	
• OU# Same # as in ND	OU# if leased or R-Loop -Zero if a switched line	Bin(2)	'0000'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	

• Inbound Pacing	Defines # transmissions before a pacing response is needed. Pacing term to host. Always binary zero: no pacing in this direction.	Bin(2)	'0000'X
• Outbound Pacing	Defines # transmissions before a pacing response is needed. Pacing host to term. Always a binary zero for displays: no pacing.	Bin(2)	'0000'X
• RU Buffer Size	Maximum Request Unit length	Bin(2)	'0100'X
• ACTLU	Indicates that the display needs an ACTLU to be activated.	Char(1)	'01'X
• ACTLU Parameters	SNA ACTLU data for the display	Char(3)	'000101'X
• ACTLU Response	Return area for ACTLU response	CHAR(8)	All binary zeros
Load/Dump Indicator	N/A	Char(4)	Binary zero

For all devices except 327X:

Specific Characteristics	N/A	Bin(2)	'0000'X
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For 3277, 3278 and 3279 devices:

Specific Characteristics	- Length of Specific Characteristics	Bin(2)	'0000'X or '0014'X if a World Trade Keyboard is specified
	- Reserved	Char(12)	binary zeros
	- Translate Table Name	Char(8)	See table below

<u>Translate Table</u>	<u>Language</u>
#TPNTAGI	Austrian/German
#TPNTBLT	Belgium
#TPNTBRT	Brazilian
#TPNTCAI	Canadian/French
#TPNTDMI	Denmark
#TPNTFAI	French
#TPNTFNI	Finland
#TPNTITI	Italy
#TPNTNWI	Norway
#TPNTPRI	Portugal
#TPNTSPI	Spain
#TPNTSSI	Spanish speaking
#TPNTSWI	Sweden

Retry Value Sets	N/A	Bin(2)	'0000'X
Error Threshold Sets	N/A	Bin(2)	'0000'X

For all devices except 5555:

Device Specific Data Area	- Length of Device Specific Area	Bin(2)	'0002'X
	- Length of Modifiable Area	Bin(2)	'0002'X
Device Specific Contents	- Reserved	Bin(2)	'0000'X
For Device Type '5555' (KANJI):			
Device Specific Data Area	- Length of Device Specific Area	Bin(2)	'0014'X
	- Length of Modifiable Area	Bin(2)	'0014'X
Device Specific Contents	- Reserved	Bin(2)	'0000'X
	- Reserved	Bin(2)	'0000'X
	- Extension Character	Char(16)	
	- Object Space Point (see Section 5.4.5.5) Note: This is a copy of a space pointer, not a true space pointer.		
			Address of IGC Character Table Binary zero if object does not exist.

5.2.5.1.3 LUD TEMPLATE DATA FOR THE 5252 DISPLAY

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	Logical unit that is attached to a CD	Char(2)	'30'
Device Type	-The devices IBM product number	Char(4)	'5252'
Model Number	-The devices model number	Char(4)	'0001' indicates 960 character screen. This device is not supported for attachment to 5294 controllers.
Physical Address	Logical units complete network address	Char(8)	
• Reserved	These two bytes always zero	Bin(2)	'0000'X
• LU Address (DAF)	Destination address of the display head (LSID) Select one of the following: -Address of displays hung off of remote cluster feature	Bin(2)	'0002'X to '0009'X
• Station Line Address	Same address as in CD this LU attaches to	Bin(2)	
• OU# Same # as in ND	OU# if leased or R-Loop -Zero if a switched line	Bin(2)	'0000'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	
• Inbound Pacing	Defines # transmissions before a pacing response is needed. Pacing term to host. Always binary zero: no pacing in this direction.	Bin(2)	'0000'X
• Outbound Pacing	Defines # transmissions before a pacing response is needed. Pacing host to term. Always a binary zero for displays: no pacing.	Bin(2)	'0000'X
• RU Buffer Size	Maximum Request Unit length	Bin(2)	'0100'X
• ACTLU	Indicates that the display needs an ACTLU to be activated.	Char(1)	'01'X
• ACTLU Parameters	SNA ACTLU data for the display	Char(3)	'000101'X
• ACTLU Response	Return area for ACTLU response	CHAR(8)	All binary zeros
Load/Dump Indicator	N/A	Char(4)	binary zero
Specific Characteristics	N/A	Bin(2)	'0000'X

Retry Value Sets	N/A	Bin(2)	'0000'X
Error Thres- hold Sets	N/A	Bin(2)	'0000'X
Device Speci- fic Data Area	- Length of Device Specific Area	Bin(2)	'0002'X
	- Length of Modifiable Area	Bin(2)	'0002'X
Device Speci- fic Contents	Reserved	Bin(2)	'0000'X

5.2.5.1.4 LUD TEMPLATE DATA FOR THE 5256, 5224, 5225, 5219, 3287, 5553 PRINTERS

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	Logical unit that is attached to a CD	Char(2)	'30'
Device Type	-The devices IBM product number	Char(4)	Select one: '5256' '5224' '5225' '5219' '3287' '5553'
Model Number	-The devices model number	Char(4)	For 5256: '0001' 40CPS '0002' 80CPS '0003' 120CPS For 5224: '0001' 137LPM '0002' 240LPM '0012' 55/440 CPS (IGC) Note - This model is only supported for attachment to 5294 Model K01 controllers For 5225: '0001' 280LPM '0002' 400LPM '0003' 490LPM '0004' 560LPM '0011' 85/300 LPM (IGC) '0012' 140/475 LPM (IGC) Note - models 0011 and 0012 only supported for attachment to 5294 Model K01 controller For 5219: '0001' 40 CPS '0002' 60 CPS For 3287 ' ' - 4 blanks For 5553: ' B01' 40/120 CPS (IGC) Note - This model is only supported for attachment to 5294 model K01 controllers.
Physical Address	Logical units complete network address	Char(8)	
• Reserved	These two bytes always zero	Bin(2)	'0000'X
• LU Address (DAF)	Destination address of the printer (LSID) Select one of following: - Address of printers hung off of remote cluster feature	Bin(2)	'0002'X to '0009'X for 52XX if attached to 5251-12 controller '0002'X to '0021'X for 3287 For devices attached

to 5294 controller:
 '0000'X to '0006'X on Port 0
 '0007'X to '000D'X on Port 1
 '000E'X to '0014'X on Port 2
 '0015'X to '001B'X on Port 3

• Station Line Address	Same address as in CD this Lu attaches to	Bin(2)	
• OU# Same # as in ND	-OU# if leased or R-Loop -Zero if a switched line	Bin(2)	'0000'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	
• Inbound Pacing	N/A	Bin(2)	'0000'X
• Outbound Pacing	Defines #transmissions before a pacing response is needed. Pacing host to printer.	Bin(2)	'0003'X
• RU Buffer Size	Maximum Request unit Length	Bin(2)	'0100'X
• ACTLU	Indicates that the printer needs an ACTLU to be activated	Char(1)	'01'X
• ACTLU Parameters	SNA ACTLU data for the printer	Char(3)	'000101'X
• ACTLU Response	Return area for ACTLU response	Char(8)	Binary zero
Load/Dump Indicator	N/A	Char(4)	Binary zero
Specific Characteristics	N/A	Bin(2)	'0000'X
Retry Value Sets	N/A	Bin(2)	'0000'X
Error Threshold Sets	N/A	Bin(2)	'0000'X

For non-Kanji Printers (all devices except 5553/B01, 5224/0012, 5225/0011, 5225/0012):

Device Specific Data Area	- Length of Device Specific contents area	Bin(2)	'0002'X
	- Length of Modifiable area	Bin(2)	'0002'X
Device Specific Contents Area	Reserved	Bin(2)	'0000'X

For Kanji Printers (5553/B01, 5224/0012, 5225/0011, 5225/0012):

Device Specific Data Area	- Length of Device Specific Area	Bin(2)	'0014'X
	- Length of Modifiable Area	Bin(2)	'0014'X
Device Specific Contents	- Reserved	Bin(2)	'0000'X
	- Reserved	Bin(2)	'0000'X
	- Extension Character	Char(16)	Address of IGC
	- Object Space Point (see Section 5.4.5.5)		Character Table Binary zero if object

Note: This is a copy of
a space pointer,
not a true space
pointer.

does not exist.

5.2.5.2 S/38 Secondary Support

5.2.5.2.1 CD TEMPLATE DATA FOR S/38 SECONDARY PHYSICAL UNIT 2

This template represents the characteristics of the controller at the other end of the network and the attributes we require it to use when conversing with System/38. In this case, the controller represents the SDLC primary station which has the SNA PU (physical unit) which communicates with the corresponding secondary physical unit in the System/38 at this end of the network. This secondary physical unit type 2 is used in conjunction with the PLU1 (3270) support (so called LU-1) and also with the PLU1 (3270) support (so called 3270 emulation) as described in the next sections.

Field Name	Description	Length	Data
CD Type	Controller descriptor that is attached to an 'ND'.	Char(2)	'10'
Unit Type	- The controllers SNA attributes as a primary station.	Char(4)	'PU2 '
Model Number	- The controllers model number	Char(4)	'0000'
Physical Address	Controllers complete network Address	Char(8)	
• Reserved	These four bytes always zero	Bin(4)	'00000000'X
• Station line Address - Reserved		Bin(2)	'0000'X
• Operational Unit #(OU#)	- OU # from the corresponding ND if a leased line - Zero if a switched line	Bin(2)	'0000'X
Power Control	Not used	Char(2)	'0000'X
Station Control Information	This data describes the station and its operating modes	Char(32)	
• XID Information	Layout directly from SNA Note: The role of this area for secondary support is only to supply the secondary IOM with essential data for protocols and buffering. This is not used as an XID by secondary support.	Char(21)	
- XID format	Indicates usage of the variable length format	Bit(4)	'0001'B
- Physical Unit Type (PU)	PU Type 2 which implies FID2 headers for transmission	Bit(4)	'0010'B
- XID Information Length	Length of this variable format	Bit(8)	'14'X
- Station's Name		Char(4)	
Block #	Manufacturing assigned product number	Bit(12)	'000'X
Specific ID	User assigned id (set to binary zero)	Bit(20)	'00000'X
- Reserved		Char(2)	'0000'X

- Configuration flags	-This specifies HDX support	Bit(8)	'00'X
- PU characteristics	This indicates no segments are allowed and PU can receive RUs from SSCP	Bit(8)	'30'X - No Segmenting '20'X - Allow Segmenting
- Maximum Length received	This field specifies the maximum length for the basic path information unit (PIU TH RH RU segment)	Bin(2)	'0109'X for 256 byte RUs with 9 byte TH+RH '0209'X for 512 byte RUs with 9 byte TH+RH
- Reserved		Char(4)	'00000000'X
- Frames Limit	SDLC maxout count: number frames that can be transmitted before acknowledgment is needed.	Bit(8)	'07'X
- Reserved		Char(4)	'00000000'X
• Station Definition	-Defines the type of connection and role played by the primary station.	Char(1)	
- SDLC Link		Bit(2)	B'10'
- Link Type		Bit(1)	B'0' - Nonswitched B'1' - Switched
- Stations Role		Bit(1)	B'1' - Primary station
- Switched Network Backup		Bit(1)	B'0' - No backup B'1' - Switched backup
- Data Rate Selection Feature		Bit(1)	B'0' - No Modem feature B'1' - Yes, has feature
- Reserved		Bit(2)	B'00'
• Reserved		Char(2)	'0000'X
• Path Information Unit Type	SNA transmission header (TH) that primary station uses	Bin(2)	'0002'X: FID2 as physical unit Type 2, Transmission Profile 3
• Reserved		Char(6)	Binary zero
Selected Modes	Defines user selectable Features -Indicates station runs in a leased environment -Indicates that station runs in a switched network backup environment	Char(2)	'0000'X '1000'X
Delayed Contact Control	Delayed Station Contact Control	Char(2)	'0000'X - not in effect
Activate Physical Unit Data	ACTPU Fields defined as follows	CHAR(16)	
• ACTPU Required	Indicates ACTPU data to be transmitted from Host (primary) to S/38 (secondary).	CHAR(1)	'00'X
• Request Code		Char(1)	'11'X
• Type Activation		Char(1)	'01'X Cold '02'X ERP

• Profiles	Function Manager Profile 0 Transmission Profile 1	Char(1)	'01'X
• SSCP-ID	PU Type 2 Installation SSCP-ID as defined for the host (primary) system	Char(6) Char(1) Char(5)	'05'X SSCP-ID
Dial Digits	Phone number if a switched station		
• Reserved		Char(6)	All binary zeros
• Length	- Number of dial digits	Bin(2)	
• Digits	-Actual phone number. May only contain digits 0-9 and separator (SEP) char- acter X'7D' and End of Number (EON) character X'5C'. These special patterns are represented by apostrophe and asterisk keys on EBCDIC keyboards.		
• Reserved		Char(8)	Binary zero
Specific Characteristics	N/A	Bin(2)	'0000'X
XID Informa- tion Area	N/A		
• Length of XID Data		Bin(2)	'0014'X
Unit Specific Data Area	- Lenth of unit specific area - Length of modifiable area	Bin(2) Bin(2)	'0002'X '0002'X
Unit Specific Contents Area	- Reserved	Bin(2)	'0000'X

5.2.5.2.2 LUD TEMPLATE DATA FOR THE SNA PLU1 (3770 NONPROGRAMMABLE, Interactive, Keyboard/Console/Printer Support)

This template represents the characteristics of the logical unit (SNA-LU) at the other end of the communication network which is the primary station on the network while the System/38 at this end is a secondary station. Several LUDs can exist to represent the several LU (logical unit) end users at the primary end which can conduct simultaneous logical sessions to several logical units in this System/38.

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	Logical unit that is attached to a CD	Char(2)	'30'
Device Type	-The logical unit's SNA attributes	Char(4)	PLU1
Model Number	-The devices model number	Char(4)	'0000'
Physical Address	Logical units complete network address	Char(8)	
• Reserved	These two bytes always zero	Bin(2)	'0000'X
• LU Address (DAF)	Destination address of the SLU1	Bin(2)	'0000'X-'00FF'X
• Station Line Address		Bin(2)	'0000'X
• OU# Same # as in ND	OU# if leased -Zero if a switched line	Bin(2)	'0000'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	
• Inbound Pacing	N/A	Bin(2)	'0000'X
• Outbound Pacing	N/A	Bin(2)	'0000'X
• RU Buffer Size	Maximum Request Unit length	Bin(2)	('0100'X) (n) for (256) (n) bytes. "n" may be a value from 1 to 16. (ie 256 to 4096 byte RU's are allowed)
• ACTLU	Indicates that the logical unit does not need an ACTLU to be activated.	Char(1)	'00'X
• ACTLU Parameters	SNA ACTLU data for the logical unit	Char(3)	'000000'X
• ACTLU Response	Return area for ACTLU response	CHAR(8)	All binary zeros
Load/Dump Indicator	N/A	Char(4)	binary zero
Specific Characteristics	N/A	Bin(2)	'0000'X
Retry Value Sets	N/A	Bin(2)	'0000'X
Error Thres-	N/A	Bin(2)	'0000'X

hold Sets

Device Specific Data Area	- Length of Device Specific Area	Bin(2)	'0002'X
	- Length of Modifiable Area	Bin(2)	'0002'X
Device Specific Contents	Reserved	Bin(2)	'0000'X

5.2.5.2.3 LUD TEMPLATE DATA FOR SNA PLU1 (3270 EMULATION)

This template represents the characteristics of the logical unit (SNA-LU) at the other end of the communication network which is the primary station on the network while the System/38 at this end is a secondary station. Several LUDs can exist to represent the several LU (logical unit) end users at the primary end which can conduct simultaneous logical sessions to several logical units in this System/38.

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	Logical unit that is attached to a CD	Char(2)	'30'
Device Type	-The logical unit's SNA attributes	Char(4)	PLU1
Model Number	-The devices model number	Char(4)	'0001'
Physical Address	Logical units complete network address	Char(8)	
• Reserved	These two bytes always zero	Bin(2)	'0000'X
• LU Address (DAF)	Destination address of the SLU1	Bin(2)	'0000'X-'00FF'X
• Station Line Address		Bin(2)	'0000'X
• OU# Same # as in ND	OU# if leased -Zero if a switched line	Bin(2)	'0000'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	
• Inbound Pacing	N/A	Bin(2)	'0000'X
• Outbound Pacing	N/A	Bin(2)	'0000'X
• RU Buffer Size	Maximum Request Unit length	Bin(2)	('0100'X) (n) for (256) (n) bytes. "n" may be a value from 1 to 16. (ie 256 to 4096 byte RU's are allowed)
• ACTLU	Indicates that the logical unit does not need an ACTLU to be activated.	Char(1)	'00'X
• ACTLU Parameters	SNA ACTLU data for the logical unit	Char(3)	'000000'X
• ACTLU Response	Return area for ACTLU response	CHAR(8)	All binary zeros
Load/Dump Indicator	N/A	Char(4)	binary zero
Specific Characteristics	N/A	Bin(2)	'0000'X
Retry Value Sets	N/A	Bin(2)	'0000'X
Error Threshold Sets	N/A	Bin(2)	'0000'X

Device Specific Area	Defines the unique device parameters	Char(36)	
-- Length of Device Specific Area		Bin(2)	'0020'X
-- Modifiable length of Device Specific Area		Bin(2)	'0010'X
-- Maximum number of input fields (Only used for 3270/5250 emulation)		Bin(2)	The Emulation terminals allowable number of input fields. Valid Values are 126-960.
-- 3270 Buffer format		Bit(2)	'01'B = 3270/5250 translation mode 10'B = 3270 Program Interface mode with field entries
-- Upper/lover case (Only used for 3270/5250 emulation)		Bit(1)	'0'B = Pass data chars a received '1'B = Convert chars to upper case of cmd.
-- Numeric lock (Only used for 3270/5250 emulation)		Bit(1)	'0'B = Numeric lock not a feature '1'B = Numeric lock is a feature
-- Reserved		Bit(4)	
-- Reserved		Bit(16)	
-- Language Option		Char(3)	where the first 2 chars are: 'AG' - Austrian/German 'BL' - Belgium 'BR' - Brazil 'CA' - Canada (French) 'DM' - Denmark 'FA' - French (Azerty) 'FN' - Finland 'FQ' - French (Qwerty) 'IN' - International 'IT' - Italian 'JE' - Japan (English) 'KA' - Japan (Kata) 'NW' - Norwegian 'PR' - Portuguese 'SP' - Spanish 'SS' - Spanish Speaking 'SW' - Swedish 'UK' - United Kingdom 'US' - United States and the last character is 'B' - Basic 'I' - International (for 'KA' only 'B' is valid)
-- Device Identification		Char(4)	'3277' Display '3284' Printer '3286' Printer '3287' Printer '3288' Printer
-- Reserved		Char(4)	

-- Reserved

Char(16)

All other LUD fields: Unused for SNA 3270 Emulation

Note: If 3284, 3286, 3287, or 3288 is defined in the device identification field, the 3270 buffer format field must not be set to 3270/5250 translation mode or an error will occur.



5.3 COMMUNICATIONS ERROR RECOVERY PROCEDURES

5.3.1 HARDWARE ERROR CODES

The following tables define the error codes and different actions or definitions based on them. The tables have the following meanings:

Table 1 - This lists all the error codes for all of the communications IOMs, what the probable cause is, the event that is signaled, and the correct recovery action to be performed.

Table 2 - This table lists the probable error locations.

Table 3 - This table lists the recommended recovery steps and sequence for each of the hardware error codes.

Table 4 - This table is a list of the hardware error codes, what they are, the probable cause of the failure and the repair action required.

The following rules applied to generating the error recovery actions:

- If the problem is caused by the far end or the application program the job should be rerun before running the Problem Determination Procedure.
- If the problem is due to the local communication hardware, the Start Problem Determination command in CPF should be run before rerunning the job. The Start PDP command was designed to catch communication hardware failures.
- If the problem is due to the remote station software the job is to be rerun before the Problem Determination Procedure is run.
- Repair Action column in table 4 is a list of ideas to try before rerunning the job or calling the CE for help.

Table 1 SUMMARY OF ERROR CODES AND ACTIONS

The following is a list of the event types and the code used to define them within the following table. It should be noted that only the events that would result in an error code being passed up to the user are defined. All the

other error codes listed may cause another event (eg. loss of contact) but are not themselves passed as event related data for one of the failure events. These error codes have an X in the event type column to indicate only whether they are line, station, or device related.

<u>Code</u>	<u>Event Type</u>	<u>Event</u>
N41	line SDLC XID failure	000E-04-01
N42	line BSC XID failure	000E-04-02
N43	line disconnect	000E-04-03
N44	line MTAM eligibility	000E-04-04
N45	line APPC XID failure	000E-04-05
N51	line failure	000E-05-01
N52	line protocol violation	000E-05-02
C41	unused	0004-04-01
C42	station contact unsuccessful	0004-04-02
C43	station loss of contact	0004-04-03
C51	station failure	0004-05-01
C52	station protocol violation	0004-05-02
C53	station LU session	0004-05-03
C54	station MTAM protocol	0004-05-04
C61	station manual intervention	0004-06-01
C62	station APPC session	0004-06-02
C63	station APPC AR/continue	0004-06-03
C64	station APPC AR/pending	0004-06-04
L41	LUD sup request unformatted	000B-04-01
L42	LUD sup request formatted	000B-04-02
L5X	LUD unused here	000B-05-XX
L61	LUD contact successful	000B-06-01
L62	LUD contact unsuccessful	000B-06-02
L71	LUD manual intervention	000B-07-01
L72	LUD not ready to ready	000B-07-02
L81	LUD failure	000B-08-01
L82	LUD device not available	000B-08-02
L83	LUD LU session inactive	000B-08-03
L84	LUD LU termination	000B-08-04
L9X	LUD unused here	000B-09-XX
LAX	LUD unused here	000B-0A-XX
X	Not applicable	
N/A	None	

LINE OR CONTROLLER TYPE

<u>TYPE</u>	<u>CODE</u>
SDLC Primary	SDLC (P)
SDLC Secondary	SDLC (S)
Bisync	BSC (B) for BSC, BSC-T (BT) for BSC-T only
Work Station	NATIVE (N) for WSC or WSC-E
Controller	(E) for WSC-E only (W) for WSC only
Bisync multi-leaving	MTAM (M)
Interconnected System	APPC (I)
Support	
BSC 3270 Emulation	B3270E (BE)
SDLC 3270 Emulation	S3270E (SE)

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	ND	CD	LUD	
0001	S I	Disconnect received- SDLC	7		C43		8,3
0001	PSB MIBS EE	Manual dial required	N/A		C61		N/A
0001	P I S E	Unacceptable response to ACTLU	7			L62	8,3
0002	B M	Disconnect received- BSC or MTAM	7		C43		8,3
0002	PSB MIBS EE	Dial operation unsuccessful	6 or 8 or 9		C42		5,6
0002	PSB MIBS EE	Device inoperative	7			L62	8,3
0003	PS I S E	XID or SSCP ID mismatch	6		C42		12,6,3
0004	PSB MIBS EE	ND not in candidate list	6		C42		12,6
0005	S I S E	CD not varied on	6		C42		12
0005	S I S E	LUD not varied on	6			L62	12
0006	B B E	First switched oper- ation mismatch on answer	6		C42		12
0006	S I S E	BIND for LUD not varied on	6			L62	12
0007	B B E	XID mismatch	6		C42		12
0008	B B E	ASCII translation error	6		C42		12
0009	M	SIGNON/LOGON invalid	6		C42		12,8,3
000A	M	SIGNON/LOGON rejected by host system	6		C42		12,8,3
000B	B M B E	Protocol violation	7		C42		8,3
000C	B B E	First switched oper- ation mismatch on	6		C42		12

	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE		PROBABLE ERROR LOCATION (See Table 2)			
			V	ND	CD	LUD
HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	ERR LOC	ND	CD	LUD
						ERROR RECOVERY ACTIONS (See Table 3)
000D	SB M BS EE	dial out Disconnect	7		C42	8,3
000E	P I	Primary received RD from XIXD	10		C42	8,3
00FF	N	Unidentified error	2		C51	1,3
01XX	N	IO Error	2,1		C51	1,3
01XX	M	MTAM RFT received XX = SRCB	6		C54	8,3
02XX	N	Command reject	1		C51	1,3
0200	M	MTAM Terminal signoff	6		C54	8,3
0201	N	Command invalid	1		C51	1,3
0202	N	Command invalid	1		C51	1,3
0203	N	Command invalid	1		C51	1,3
0204	N	Address error	1		C51	1,3
0205	N	Read data command length error	1		C51	1,3
0206	N	Command invalid for post error mode	1		C51	1,3
0207	N	Error in load poll list command	1		C51	1,3
0208	N	Write data FOB error	1		C51	1,3
0209	N	Reset command rejected due to command pending on inbound OU	1		C51	1,3
020A	E	Invalid OU	1		C51	1,3
03XX	M	MTAM RFT received XX = SRCB	6		C54	8,3
0301	N	Start device timeout	2		C51	1,3
0302	N	Channel error - OU task exception - Channel event handler error	2		C51	1,3
0303	N	Read sense command	N/A		N/A	N/A

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	--EVENTS----			
				ND	CD	LUD	
0304	N	failed during vary off (logged - no event) Read sense command failed	2		C51		1,3
0305	N	Vary Off data (logged only - no event)	N/A		N/A		N/A
0306	N	FOB time out	2		C51		1,3
04XX	M	MTAM Unsolicited Data XX = RCB	6		C54		8,3
0401	N	Selective reset failed	1		C51		1,3
0402	N	Insufficient data store	1		C51		1,3
0403	N	Device not configured	1		C51		1,3
0404	N	Translate table not installed or RAM module not installed	1		C51		1,3
0405	N	LUD device specific area invalid	1		C51		1,3
0500	N	Operation program error (OU task detected error)	1		C51		1,3
06XX	N	Post event	2		C51		1,3
0610	E	Control store data parity error	2		C51		1,3
0612	W	IOC check reset attention	2		C51		1,3
0614	E	Adapter register or interface failure	2		C51		1,3
0618	N	Adapter transmit failure	2		C51		1,3
0620	W	Control store address parity error	2		C51		1,3
0634	E	Invalid disconnect	2		C51		1,3
063C	E	Branch & link under/overflow	2		C51		1,3

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	ND	CD	LUD	
	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE						
0640	N	IOC internal parity error	2		C51		1,3
0680	N	IOC DBI parity error	2		C51		1,3
0688	W	Cable address register parity error	2		C51		1,3
0801	PS N I S E	Resource not available (LU)	7		C52		8,3
0805	I	Session Limit Reached	7		C52		8,3
0806	S I S E	Resource unknown	7		C52		8,3
0809	S I S E	Mode Inconsistency	7		C52		8,3
080C	S I S E	Procedure Not Supported	7		C52		8,3
0813	I	Bracket bid reject - no RTR	7		C52		8,3
0814	I	Bracket bid reject - RTR	7		C52		8,3
0815	S I S E	Function Active	7		C52		8,3
081D	S I S E	Invalid SSCP ID	7	N2			8,3
0821	S I S E	Invalid Session Parameters	7		C52		8,3
0835	I	Invalid Parameter	7		C52		8,3
0846	I	ERP message coming	7		C52		8,3
0882	I	RTR not supported	7		C52		8,3
1001	I	RU data error	7		C52		8,3
1002	I	RU length error	7		C52		8,3
1003	S I S E	Function Not Supported	7		C52		8,3
1008	I	Invalid FM header	7		C52		8,3
2001	I	Invalid sequence number	7		C52		8,3
2002	I	Chaining error	7		C52		8,3

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	--EVENTS--			
				ND	CD	LUD	
2003	I	Bracket usage error	7		C52		8,3
2004	I	HDX-FF direction error	7		C52		8,3
2005	S I S E	Data Traffic Reset	7		C52		8,3
2009	I	SC or DFC protocol violation	7		C52		8,3
200B	I	Queued response error	7		C52		8,3
200E	I	Stray response	7		C52		8,3
200F	I	Response protocol violation	7		C52		8,3
2107	PS I S E	Input buffer not available (logged only - no event)	N/A	N/A	N/A	N/A	N/A
2117	PSB MIBS EE	Vary Off ND (logged only-no event)	N/A	N/A	N/A	N/A	N/A
2127	PSB MIBS EE	Vary Off CD (logged only-no event)	N/A	N/A	N/A	N/A	N/A
2137	P	Vary OFF CD Kanji Remote	N/A	N/A	N/A	N/A	N/A
3206	I	UNBIND SESSION Session parameters not valid	7		C52		8,3
3207	I	UNBIND SESSION Virtual path not working	7		C52		8,3
3208		UNBIND SESSION Path extension not not working	7		C52		8,3
3209		UNBIND SESSION reset	7		C52		8,3
320A		UNBIND SESSION SSCP gone	7		C52		8,3
320B		UNBIND SESSION Virtual path deactivated	7		C52		8,3
320C		UNBIND SESSION LU failure-not	7		C52		8,3

	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE		PROBABLE ERROR LOCATION (See Table 2)				
			ERR LOC	ND	CD	LUD	
HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)					ERROR RECOVERY ACTIONS (See Table 3)
		recoverable					
320E		UNBIND SESSION LU failure-Recoverable	7		C52		8,3
320F		UNBIND SESSION session reset before response	7		C52		8,3
3211		UNBIND SESSION gateway node cleanup	7		C52		8,3
32FE		UNBIND SESSION Session failure	7		C52		8,3
4003	I	Begin brackets not allowed	7		C52		8,3
4004	I	End bracket not allowed	7		C52		8,3
4005	PS I S E	Incomplete RH	7	N52	C52		8,3
4007	I	Definite response not allowed	7		C52		8,3
4008	PS I	Pacing Not Supported	7		C52		8,3
4009	I	Change direction not allowed	7		C52		8,3
400B	I	Chaining not supported	7		C52		8,3
400C	I	Brackets not supported	7		C52		8,3
400F	I	Incorrect use of FI	7		C52		8,3
4010	I	Alternate code not supported	7		C52		8,3
4011	I	Incorrect RU category	7		C52		8,3
4012	I	Incorrect request code	7		C52		8,3
4013	I	SDI-ERI do not match	7		C52		8,3
4014	I	Incorrect use of RSP IND.	7		C52		8,3
4015	I	QRI usage error	7		C52		8,3
4016	I	Incorrect use of EOI	7		C52		8,3

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	ND	CD	LUD	
	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE						
4017	I	Incorrect use of PDI	7		C52		8,3
4018	I	Invalid use of QRI W.R.T. BBI	7		C52		8,3
4019	I	Invalid end-chain RH settings	7		C52		8,3
4021	I	QRI of req and QRI of RSP do not match	7		C52		8,3
8004	PS N I S E	Unrecognized DAF	7		C52		8,3
8005	S I S E	No Session	7	N52	C52		8,3
8006	PS I S E	Invalid FID	7	N52	C52		8,3
8007	PS I S E	Segmenting Error	7	N52	C52		8,3
8008	S I S E	PU not active	7	N52			8,3
8009	S I S E	LU not active	7		C52		8,3
800A	P	PIU too long	7		C52		8,3
800B	PS I S E	Incomplete TH	7	N52	C52		8,3
8049	PSB MIBS EE	OP program error	1	N51			1,2,3
808B	PSB MIBS EE	Channel Error	2	N51			1,2,11,3
80AC	PSB MIBS EE	IOC Command Reject	1	N51			1,2,3
8103	PSB MIBS EE	Post Event	2	N51			1,2,11,3
8107	PSB MIBS EE	BSTAT not valid	2	N51			1,2,3
8137	PSB MIBS EE	Read Sense Failure	2	N51			1,2,3
81C3	PSB MIBS EE	IOC/CA Parity Error, Addressing Modem Port	2	N51			1,2,3

	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE		PROBABLE ERROR LOCATION (See Table 2)				
			↓ V	↓ V	↓ V	↓ V	
HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	ERR LOC	ND	CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
81E3	PSB MI S E	IOC/CA Parity Error, Addressing ACU Port	2	N51			1,2,3
8204	PSB MIBS EE	DTR not active or DTR Dropped	2	N51			1,2,3
8210	S I S E	SDLC Normal Disconnect	6	N51			
8224	PSB MIBS EE	DSR Timeout or DSR Dropped	3	N51			1,2,5,3,4
8225	B M B E	Paired Command Timeout	2	N51			1,2,3,4
8244	PSB MI S E	Invalid Auto Answer Request	3	N51			1,2,5,4,3
8264	PSB MI S E	DSR Timeout on Auto Answer	3	N51			2,5,3
8284	PSB MI S E	DSR/RI Auto Answer Sequence Error Reset RI Timeout	3	N51			2,5,3
8360	PSB MIBS EE	Line not initialized	1	N51			1,2,3
8380	P B MI	Switched Line Disconnect Timeout	4 or 7	N51	C51		1,2,9,4,3
83C0	B M B E	Invalid BSC Command Sequence	1	N51			1,2,3
8401	PSB MIBS EE	Channel Disconnect Detected at IOC	5	N51			1,2,3,4
84E2	PSB MIBS EE	Adapter Interrupt Request Failure	3 or 2	N51			1,2,3
9188	B M	Disconnect abort received	6	N51	C51		1,2,8,4,3
9207	P I	SDLC Cmd Reject	7		C51		1,2,8,4,3
9208	B B E	EOT abort	6	N51	C51		1,2,8,4,3
9217	P I	SDLC Disconnect Mode	7	N51	C51		1,2,8,4,3
9227	P I	SDLC out of Range Sequence Numbers	7	N51	C51		1,2,8,4,3

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	--EVENTS--			
				ND	CD	LUD	
9237	P I	Wrong SDLC address	7	N51	C51		1,2,8,4,3
9388	B B E	Forward EOT abort	6	N51	C51		1,2,8,4,3
93A0	B M B E	Invalid Transmit	4	N51	C51		1,2,9,4,3
93AB	M	Wrong format from host	6	N51	C51		1,2,8,4,3
93E0	B M B E	Continuous SYN Transmit	1	N51			1,2,3
93F0	B B T E	BSC Protocol Timeout	5	N51	C51		1,2,8,4,3
9408	B	Forward Disconnect abort	6	N51	C51		1,2,8,4,3
9578	B E	EOT, host aborted read command	6			L81	1,2,8,4,3
9588	B	Remote Protocol Violation Conversational Reply	6		C51		1,2,8,4,3
9598	B E	Remote Protocol Violation-limited reply	6			L81	1,2,8,4,3
96A5	PSB MIBS EE	RLSD Timeout	7	N51	C51		1,2,12,8, 3,4
9745	B M B E	Continuous SYN Received	7	N51	C51		1,2,8,3,4
9765	B B T E	Unexpected SYN Received	7	N51	C51		1,2,8,4,3
A200	S I S E	Unexpected SNRM	7		C51		1,2,8,4,3
A210	S I S E	Unexpected disconnect received.	7		C51		1,2,8,4,3
A220	S I S E	SDLC Frame Reject	7		C51		1,2,8,4,3
A230	S I S E	Unexpected DACTPU	7		C51		1,2,8,4,3
A240	S I S E	Unexpected DACTLU	7			L81	1,2,8,4,3

	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE		PROBABLE ERROR LOCATION (See Table 2)				
			ERR LOC	ND	CD	LUD	
HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)					ERROR RECOVERY ACTIONS (See Table 3)
A250	S I S E	Unexpected ACTPU	7		C51		1,2,8,4,3
A260	S I S E	Unexpected ACTLU	7			L81	1,2,8,4,3
A380	S I S E	Switched line Disconnect Timeout	4 or 7	N51			1,2,4,3
B020	P	Incomplete download (5294 only)	7		C52		8,3
B021	P	Bad device config for download (5294)	7		C52		8,3
B104	P I	Received excessive negotiable XID responses	10	N45	C42		1,2,8,4,3
B106	PS I S E	Error control vector in received XID	10	N45	C42		1,2,8,4,3
B108	I	Received XID response with invalid data	10	N45	C42		1,2,8,4,3
D019	P N	Invalid RAM Address (Kanji Device)	1,2	N/A	N/A	N/A	1
D020	P N	RAM Contents List Missing in SSD (Kanji Device)	1,2	N/A	N/A	N/A	1
D021	P N	SSD Save Area Invalid (Kanji Device)	1,2	N/A	N/A	N/A	1
E2C4	PSB MIBS EE	RTS Inactive or RTS Dropped	2	N51			1,2,3
E2E4	PSB MIBS EE	CTS active before RTS	2 or 3	N51			1,2,5,3,4
E324	PSB MIBS EE	CTS Timeout or CTS Dropped	2 or 3	N51			1,2,5,3,4
E506	PSB MI S E	Reset ACU timeout	8	N51			1,2,5,3,4
E526	PSB MI S E	Data Line Occupied Timeout	8	N51			1,2,5,3,4

HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	PROBABLE ERROR LOCATION (See Table 2)				ERROR RECOVERY ACTIONS (See Table 3)
			ERR LOC	--EVENTS--			
				ND	CD	LUD	
E546	PSB MI S E	'Abandon Call Retry' on ACU Call Request	8	N51			1,2,5,3,4
E566	PSB MI S E	PND timeout on first digit	8	N51			1,2,5,3,4
E586	PSB MI S E	'Digit Present' Timeout	8	N51			1,2,5,3,4
E5A6	PSB MI S E	ACR on digit present	8	N51			1,2,5,3,4
E5C6	PSB MI S E	ACR waiting for PND	8	N51			1,2,5,3,4
E5E6	PSB MI S E	PND timeout	8	N51			1,2,5,3,4
E606	PSB MI S E	'Distant Station Connected' Timeout Note: No failure event will be sig- naled. CD contact unsuccessful only will be signaled. An error log entry will be made.	6 or 8				6
E626	PSB MI S E	ACR Received, Waiting for DSC Note: No failure event will be sig- naled. CD contact unsuccessful only will be signaled. An error log entry will be made.	6 or 8				6
F088	B M B E	NAK to text or line bid	9	N51	C51		1,2,8,4,3
F108	B B E	Wrong ACK to text sent	7	N51	C51		1,2,8,4,3
F109	M	Wrong block sequence received	7	N51	C51		1,2,8,4,3
F288	B B E	ENQ received to text sent	9	N51	C51		1,2,8,4,3
F308	B M B E	Protocol violation	7	N51	C51		1,2,8,4,3
F441	PSB MIBS EE	Data Overrun or Channel Disconnect	5	N51	C51		1,2,4,3

	SS8NMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE		PROBABLE ERROR LOCATION (See Table 2)				
			V	---EVENTS---	V	V	
HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	ERR LOC	ND	CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
F481	PSB MIBS EE	Data Underrun or Channel Disconnect	5 or 2	N51	C51		1,2,4,3
F488	B B E	ENQ to ACK sent	7 or 9	N51	C51		1,2,8,4,3
F4C2	PSB MIBS EE	Adapter overrun or Adapter underrun	5	N51	C51		1,2,4,3
F507	P I	Undefined SDLC Control Field	7	N51	C51		1,2,8,4,3
F517	PS I S E	SDLC Sequence error, Transmit Failure	3 7 or 9	N51	C51		1,2,8,4,3
F527	PS I S E	SDLC Sequence error, Receive Failure	3 7 or 9	N51	C51		1,2,8,4,3
F660	PSB MIBS EE	MS Buffer Overrun	6 or 9	N51	C51		1,2,4,3
F705	PS I S E	Idle State Detected	3 7 or 9	N51	C51		1,2,8,4,3
F725	B M B E	Receive timeout, data transfer state	7 or 9	N51	C51		1,2,8,4,3
F735	B	Receive timeout, contention state	6 or 9	N51	C51		1,2,8,4,3
F765	B M B E	Sync Lost	7 or 9	N51	C51		1,2,8,4,3
F7A5	PS I S E	Non productive RCV Timeout	7 or 9	N51	C51		1,2,8,4,3
F7C5	PS I S E	Frame abort	7	N51	C51		1,2,8,4,3
F7E5	B	Redundancy Check (VRC)	7 or 9	N51	C51		1,2,5,4,3

	SSBNMABS DDSATP33 LLCTAP22 CC IMC77 PS V 00 E EE		PROBABLE ERROR LOCATION (See Table 2) ↓ V ↓ V ↓ V ↓ V				
HARDWARE ERROR/ STATUS CODE	LINE OR CONTROLLER TYPE	ERROR EXPLANATION (See Table 4)	ERR LOC	ND	CD	LUD	ERROR RECOVERY ACTIONS (See Table 3)
F805	PSB MI S E	Redundancy check (CRC/LRC)	7 or 9	N51	C51		1,2,5,4,3

5.3.2 ERROR RECOVERY DESCRIPTIONS FOR HARDWARE ERROR CODES

Table 2 PROBABLE ERROR LOCATION

1. Problem in IBM software (VMC).
2. Problem in IBM hardware or HMC.
3. Problem in local modem or CPU-modem interface cables.
4. Problem in MI program - no commands issued, invalid data.
5. Problem in system overcommitment of resources.
6. Problem in remote system or program/application mismatch between this system and remote system.
7. Problem in remote system.
8. Problem in ACU or CPU-ACU interface cables.
9. Problem in network - noise, echos, dropouts.
10. Problem in remote system or configuration mismatch between ends.

Table 3 ERROR RECOVERY ACTIONS

1. Vary off LUDs and Vary off CD (if a CD failure event was signaled).
2. Vary off ND if failure event was an ND failure.
3. Refer to PDP Key description in PDP Guide, SC21-7876.
4. Rerun job (vary on objects as required).
5. Check modem and/or ACU power and switch settings.
6. Verify the Dial Digits in the CD object. Reissue the MODCD (dial out) instruction.
7. Unused
8. Notify far end operator of error.
9. Fix application program.
10. Unused
11. Do recovery actions 1 and 2 for all links on failing IOC then do recovery actions for all jobs affected.
12. Verify correctness of the system objects (ND,CD).

Note: This table is to be used only after any appropriate retries have been done.

Table 4
DETAIL ERROR DESCRIPTIONS

Error Code	Error Name Description Repair Action
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Note: A list of acronyms is included at the end of this table.

00FF	Unidentified error An error status occurred which was invalid. Repair Action : Call the CE, the hardware is failing.
01XX	I/O Error The work station adapter has issued an IO error. Repair Action : Call the PSR or CE, the VMC or hardware is failing.
02XX	Command reject The adapter has rejected the command that was issued to it. BSTAT byte 1 is not in a valid range. Repair Action : Call the PSR, the VMC is failing.
0201	Command invalid or invalid for startup mode. Repair Action : Call the PSR, the VMC is failing.
0202	Command invalid The command is invalid or invalid for inbound queue in normal mode. Repair Action : Call the PSR, the VMC is failing.
0203	Command invalid The command is invalid or invalid for outbound queue in normal mode. Repair Action : Call the PSR, the VMC is failing.
0204	Address error Address error in read or write data store command. Repair Action : Call the PSR, the VMC is failing.
0205	Read data command length error

Read data command data length is not modulo eight.

Repair Action : Call the PSR, the VMC is failing.

0206	Command invalid for post error mode Repair Action : Call the PSR, the VMC is failing.
0207	Error in load poll list command Repair Action : Call the PSR, the VMC is failing.
0208	Write data FOB error Repair Action : Call the PSR, the VMC is failing.
0209	Reset command rejected due to command pending on inbound OU Repair Action : Call the PSR, the VMC is failing.
020A	Invalid OU - command reject (WSC-E only) Repair Action : Call the CE, the hardware is failing.
0301	Start device timeout Repair Action : Call the CE, the hardware is failing.
0302	Channel error - OU task exception - Channel event handler error Repair Action : Call the CE, the hardware is failing.
0303	Read sense command failed during vary off
0304	Read sense command failed Repair Action : Call the CE, the hardware is failing.
0305	Vary off data
0306	FOB timeout Repair Action : Call the CE, the hardware is failing.
0401	Selective reset failed Repair Action : Call the CE, the hardware is failing.
0402	Insufficient data store. This failure occurs on Vary On CD if the configured CD and LUDs for the work station controller require more data store than is currently installed on the

Error Code	Error Name Description Repair Action
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	work station controller (as indicated in the MCR).	0610	Control store data parity error
	Repair Action : Reconfigure the work station LUDs to use less WSC data store by reducing the number of translate tables, format tables, print buffers or reduce the number of LUDs attached (configured) to this CD. Alternatively, request the CE to install more data store if possible.		Repair Action : Call the CE, the hardware is failing.
		0612	IOC check reset attention
			Repair Action : Call the CE, the hardware is failing.
		0614	Adapter register or interface failure
			Repair Action : Call the CE, the hardware is failing.
		0618	Adapter transmit failure
			Repair Action : Call the CE, the hardware is failing.
0403	Device (OU#) not properly configured in MCR.	0620	Control store address parity error
	Repair Action : Call the PSR, the MCR must be corrected (MCR update).		Repair Action : Call the CE, the hardware is failing.
0404	Translate table not installed in VMC which corresponds to one of the LUD translate table names or RAM module not installed (WSE-E only) which corresponds with one of the LUD RAM module names. The name will be identified in the error log entry which has been made and will be identified there as either a translate table name or a RAM module name.	0634	Invalid disconnect
	Repair Action : Call the PSR, the VMC is failing.		Repair Action : Call the CE, the hardware is failing.
		063C	Branch and link under/over flow
			Repair Action : Call the CE, the hardware is failing.
		0640	IOC internal parity error
			Repair Action : Call the CE, the hardware is failing.
0405	LUD device specific area invalid. For printers, the number of print buffers must be 3-7 and equal to or greater than the outbound pacing count. For displays, the number of format tables must be 1-3 for WSC or 1-7 for WSC-E. The event data contains a system pointer to the problem LUD.	0680	IOC DBI parity error
	Repair Action : Correct the values in the LUD and reissue to vary on CD.		Repair Action : Call the CE, the hardware is failing.
0500	Operation program error (OU task detected error)	0688	Cable address register parity error. Invalid cable address. Cable address specified in the LUD(s) may not conform to the WSC connectors installed on the system. (WSC only - not signaled on WSC-E.)
	Repair Action : Call the PSR, the VMC is failing.		Repair Action : Verify the cable addresses in the LUD(s). If valid, call the CE, the hardware is failing.
06XX	Post event (hardware failure)	0801	Resource not available
	The work station adapter has detected a post event.		For Secondary: The LU specified in a received ACTLU or BIND is not available. For primary: Either the LUD is not activated (data received after Vary On (ACTLU) but before BIND
	Repair Action : Call the CE, the hardware is failing.		

Error Code	Error Name Description Repair Action
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	or after UNBIND but prior to Vary Off (DACTLU)) or no LUD is configured on this controller with a matching LU address (LSID) or the far end controller is failing. For WSC: Data was received from a device with an inactive path. Device is varied on (ACTLU) but not activated (no BIND).		repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
	Repair Action : Verify that the affected LUD is varied on and in active session. Check the configuration of LUDs to confirm whether or not the LUDs are properly configured for the actual devices on the controller, or for the actual far end LU's (logical units) if the System/38 is a secondary or peer configuration. Contact the far end operator to assist with recovery.	080C	Procedure not supported The received request maintenance statistics (REQMS) request contains a type code that is not supported by S/38 secondary. Repair Action : Contact the far end operator. This is a far end configuration error.
		0813	Bracket bid reject-no RTR Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
0805	Session limit reached Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	0814	Bracket bid reject-RTR Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
0806	Resource unknown Received FMD request for SSCP PU path is not supported. Only REQMS is supported. Repair Action : Contact the far end operator to get the repair action. Check for configuration mismatch, either that the CDs are not created properly or that they do not match the actual resource at the far end.	0815	Function active. A BIND request was received when the LU was already found. Repair Action : Contact the far end operator to get the repair action (This is a far end software error).
		081D	Invalid Station/SSCP ID SSCP ID in the received ACTPU request is not valid. Repair Action : Verify S/38 and host SSCP ID are specified correctly in the CD object.
0809	Mode inconsistency The received second activation request (ACTPU or ACTLU) cannot be performed. Repair Action : Contact the far end operator to get the	0821	Invalid session parameters Session parameters are not valid or

Error Code	Error Name Description Repair Action
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	not supported for the session requested.		error or the two ends are not in the proper matching states (out of sync).)
	Repair Action : Contact the far end operator to get the repair action. Check for configuration mismatch, either that the CD or LUD has invalid parameters or does not match the actual far end resource (device or program).	1003	Function not supported The requested function is not supported. The System/38 does not support any SNA network control requests. Repair Action : Check for configuration mismatch, either the far end is improperly configured for System/38 or the actual connection is to a wrong far end.
0835	Invalid parameter		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	1008	Invalid FM header Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
0846	ERP message coming		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	2001	Invalid sequence number Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
0882	RTR not supported		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	2002	Chaining error Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
1001	RU data error		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	2003	Bracket usage error Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
1002	RU length error		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software		

Error Code	Error Name Description Repair Action
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2004	MDX-FF direction error		of sync).)
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	2107	Input buffer is not available
			The machine is temporarily out of input buffers for the line specified. This error code is logged but no failure condition is signaled.
			Repair Action : N/A
2005	Data traffic reset	2117	Vary off ND code.
	Data traffic state is not active and a FMD or normal flow DFC request was received by an active half session.		This error code is used for logging the SDR's for Vary off ND.
	Repair Action : System software problem at the far end. Notify the operator of this fact.		Repair Action : N/A
		2127	Vary off CD code.
			This error code is used for logging the SDR's for Vary off CD.
2009	SC or DFC protocol violation		Repair Action : N/A
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	2137	Vary Off CD - Kanji Remote
			This error code is used for logging Kanji SDR'S for Vary Off of Remote Kanji CD (5294)
		3206	Unbind session - session parameters not valid.
200B	Queued response error		Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	3207	Unbind session virtual path not working
200E	Stray response		Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	3208	Unbind session path extension not working
200F	Response protocol violation		Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)		

Error Code	Error Name Description Repair Action
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3209 Unbind session reset

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

320A Unbind session SSCP gone

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

320B Unbind session virtual path deactivated

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

320C Unbind session LU failure-not recoverable

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

320E Unbind session LU failure-recoverable

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

320F Unbind session-session reset before response

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

3211 Unbind session gateway node cleanup

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

32FE Unbind session-session failure

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4003 Begin bracket not allowed

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4004 End bracket not allowed

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4005 Incomplete RH

A transmission was received that was shorter than the full TH-RH.

Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Check for a configuration mismatch between the CD and the actual far end controller.

4007 Definite response not allowed

Repair Action : Contact the far end operator to get the repair action. (This

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is a far end software error or the two ends are not in the proper matching states (out of sync).)

error or the two ends are not in the proper matching states (out of sync).)

4008 Pacing not supported

The pacing option is not supported for this path.

Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for a configuration mismatch between the LUD and the actual far end device.

4010 Alternate code not supported

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4011 Incorrect RU category

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4009 Chance direction not allowed

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4012 Incorrect request code

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

400B Chaining not supported

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4013 SDI-ERI do not match

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

400C Brackets not supported

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

4014 Incorrect use of RSP IND

Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)

400F Incorrect use of FI

Repair Action : Contact the far end operator to get the repair action. (This is a far end software

4015 QRI usage error

Repair Action : Contact the far end operator to get the repair action. (This

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	is a far end software error or the two ends are not in the proper matching states (out of sync).)		Repair Action : For WSC : Call the PSR, the VMC is failing or call the CE for a failing device.
4016	Incorrect use of EDI		For all others : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the CD or LUD and the actual far end resource (device or program).
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)		
4017	Incorrect use of PDI		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)		
4018	Invalid use of QRI W.R.T. BBI	8005	No Session
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)		The requested LH specifies a destination for which the half session is not active.
			Repair Action : Either the LUD is not in active session or no LUD exists. Insure that the appropriate LUD is activated. Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the LUD(s) and the actual far end resources (devices or programs).
4019	Invalid end-chain RH settings		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)		
4021	QRI of req and QRI of RSP do not match		
	Repair Action : Contact the far end operator to get the repair action. (This is a far end software error or the two ends are not in the proper matching states (out of sync).)	8006	Invalid FID
			The FID is not valid for the receiving node.
8004	Unrecognized DAF		Repair Action : Contact the far end operator to see if there are any failures that would
	There was no routing information for the DAF.		

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	cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the CD or LUD and the actual far end resource (device or program).		there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the CD or LUD and the actual far end resource (device or program).
8007	Segmenting error Segmenting is not supported, but the RH indicates segmented frames. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the LUD and the actual far end resource (device or program).	800A	Too long PIU: (AMO download only) Transmission was truncated by the receiving link station because sufficient buffering was not available. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the CD or LUD and the actual far end resource (device or program).
8008	PU not active The SSCP PU session is not active and the received RU is not an ACTPU request. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Verify that the S/38 has proper device configuration attributes. Check for configuration mismatch between the CD or LUD and the actual far end resource (device or program).	800B	Incomplete TH A transmission was received that is shorter than a TH. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Check for configuration mismatch between the CD or LUD and the actual far end resource (device or program).
8009	LU not active The DAF in the received TH addresses an LU for which the SSCP LU session is not active. Repair Action : Contact the far end operator to see if	8049	Operation Program Error The OU task microcode has set on the operation program error bit in BSTATO of an ORE. Repair Action : Call the PSR or the CE the VMC or the

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	hardware is failing.		Repair Action : Call the CE, the hardware is failing.
808B	Channel Error The channel IOM has reported a channel error. Repair Action : Call the CE, the hardware is failing.	8204	DTR not active or DTR Dropped The DTR signal from the CA did not go active or was active and went not active Repair Action : Call the CE, the hardware is failing.
80AC	IOC Command Reject The IOC microcode reported a command reject condition. Repair Action : Call the PSR or the CE the VMC or the hardware is failing.	8210	SDLC Normal disconnect (for Secondary Support) Repair Action : Re-establish the connection, the far end has disconnected the line.
8103	Post Event An IOC has reported an error condition. Repair Action : Call the CE, the hardware is failing.	8224	DSR Timeout or DSR Dropped DSR inactive at the start or went inactive during transmission Repair Action : Check the external communications cables from the system to the modem and the modem to the wall to verify connection to the far end. If this is a locally attached high speed line, check the attaching cable. Verify that the ND object is correct for the hardware that is connected (especially the Switched Network and Multipoint fields. For MTAM switched links, verify also that the logon is correct for the host system application so that the host does not drop the switched connection to cause this problem.
8107	BSTAT not valid The IOC returned to the IOM an invalid BSTAT encoding. Repair Action : Call the CE, the hardware is failing.		
8137	Read Sense failure A read sense issued to the IOC did not return in 15 seconds. Repair Action : Call the CE, the hardware is failing.		
81C3	IOC/CA Parity Error, Addressing Modem Port 1. On I/O Read: DBI to IOC--detected by IOC. 2. On I/O Read or Write: ABO of IOC--detected at CA 3. On I/O Write: DBO of IOC--detected at CA Repair Action : Call the CE, the hardware is failing.	8225	Paired command timeout Read and write commands were not passed to the IOC in a timely manner. Repair Action : Call the CE or PSR, the hardware or VMC is failing.
81E3	IOC/CA Parity Error, Addressing ACU Port 1. On I/O Read: DBI to IOC--detected by IOC. 2. On I/O Read or Write: ABO of IOC--detected at CA 3. On I/O Write: DBO of IOC--detected at CA	8244	Invalid Auto Answer Request DSR active at start of auto answer operation. Repair Action : Check the cables to the modem with auto

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	answer capability. Verify that the modem switches are set properly. Verify that the ND object is correct for the hardware that is connected, especially the Auto Answer Feature, the Auto Answer Mode, and the DCE Group fields.		the correct sequence of the line reset and initialize commands.
			Repair Action : Call the PSR or CE. The VMC or hardware is failing.
8264	DSR Timeout on Auto Answer Ring indicate became active but DSR did not within 40 seconds. Repair Action : Check the external cables to the modem. Verify that the ND object is correct for the hardware that is connected, especially the Auto Answer Mode and DCE Group fields.	8380	Switched line disconnect timeout The adapter has not received a command from the IOM for 30 seconds when it is not currently working on a command. The switched line is disconnected. For BSC only, this code is also used when the IOM detects no activity on the line for approximately 30 seconds. Repair Action : For all cases except BSC, this error indicates that VMC or hardware is failing. Call the PSR or CE. For BSC this error may indicate a line timeout due to line inactivity. If the inactivity results from known conditions where no I/O operations have been requested of VMC during contention modes, the 'BSC switched inactivity disconnect timer' can be disabled (set to 1 in the ND template) to remedy the problem. If the error occurs for unknown reasons in BSC, verify that the far end application is started and is sending on the line. Verify that the Retry Values and the Receive Timeout Timer values of the ND are large enough. If the problem persists call the PSR.
8284	DSR/RI Auto Answer Sequence Error, Reset RI Timeout DSR became active while RI was inactive, AA operation or RI could not be reset in 7 seconds. Repair Action : Check the modem configuration and modem switched settings (i.e. the modem could be configured as leased or with auto answer feature mistakenly specified or the modem could be set to operate leased instead of switched, etc.). Check all the modem cables. Power the modem down and up if it is an external modem.	83C0	Invalid BSC Command Sequence The IOC received an invalid sequence of commands. Repair Action : Call the PSR the VMC is failing.
8360	Line not Initialized The IOC microcode received a command for the line without first receiving		

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8401	Channel Disconnect Detected at IOC Data Transfer was Terminated (in 'normal' mode operation): 1. Immediately for INIT, Read Data Store, Set Line Priority, or Write Data Store Command. 2. After 6.8 second timeout to transfer last 8 bytes for a read data command. Repair Action : The system is overcommitted. Readjust the storage pool sizes.
84E2	Adapter Interrupt Request Failure Byte transfer request failed due to hardware error. Repair Action : Verify that the nonclocked modem field in the ND is correct. Check all the external communications cables. If this is an external modem, power the modem down and up.
9188	Disconnect abort received. Disconnect or terminal signoff received when processing data and a data stream was not at end of file Repair Action : Contact far end operator and inform him of failure. Check far end to see if there are any program failures at the far end which caused this problem.

9207 SDLC Command Reject

Command reject received from the Secondary Station (not applicable for Secondary mode).

- Secondary's buffers could have overflowed.
- Secondary may have detected out of range SDLC sequence numbers, or a non-supported command.
- VMC failure may have occurred.

Repair Action : Contact far end operator and inform him of failure. Determine if any problem exists that would cause a violation of protocols. Contact the PSR, the VMC may be failing.

9208 EOT abort

The remote station has stopped receiving data and has sent an EOT abort.

Repair Action : Contact far end operator and inform him of failure. Determine if any far end problem exists that would cause this problem. Far end couldn't continue due to a problem (i.e. data incorrect, device failure, job canceled, etc.).

9217 SDLC Disconnect Mode

The secondary has entered disconnect mode when it should be in normal response mode (not applicable when in Secondary mode)

Repair Action : Contact far end operator and inform him of failure. Determine if any far end problem exists, such as someone powering off and on of the remote station, that would cause this problem.

9227 SDLC out of Range Sequence Numbers

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	The received Nr count had previously been transmitted and acknowledged by a previous Nr count or the received Nr count acknowledges an I-frame that has not yet been transmitted and is not the next sequential I-frame to be transmitted. Repair Action : Contact far end operator and inform him of failure. Determine if any problem exists that would cause this problem.	93E0	Continuous SYN transmit The IOC inserted more than 2 seconds of SYN chars while waiting for data from the VMC. Repair Action : Check the storage pool sizes as the system could be overcommitted.
9237	Wrong SDLC Address The polled station responded with the wrong address or a wrong station responded. Repair Action : Contact far end operator and inform him of possible failure in his controller.	93F0	BSC Protocol Timeout On a tributary line the S/38 did not respond within 2.6 seconds. Repair Action : Check the storage pool sizes as the system could be overcommitted.
9388	Forward EOT abort The remote station sent in a TTD after which he sent an EOT in response to a NAK sent by the S/38 or an EOT was received but the previous block of data ended in ETB, not ETX. Repair Action : Contact far end operator and inform him of failure. Far end can't continue due to a problem (ie. data incorrect, device failure, job canceled at far end). Contact remote operator for assistance.	9408	Forward disconnect abort The remote station disconnected the line. Also note that the switched connection has been dropped. Repair Action : Far end can't continue due to a problem (ie. data incorrect, device failure, job canceled at far end). Contact remote operator for assistance.
93A0	Invalid transmit format The data to be sent is not compatible with the BSC-MTAM protocol. Repair Action : Check the user program to verify that the data is correct.	9578	EOT, host aborted read command not satisfied The System/38 has sent EOT to the host in response to a read command since the system cannot generate data within the host's timeout interval. Repair Action : The system is over-committed. Retry the operation after reducing workload. If problem persists, contact far end for problem determination.
93AB	Wrong format from host A format was received that does not adhere to MTAM protocols. Repair Action : Call the PSR for the far end system, the far end operating system is failing.	9588	Remote protocol violation Conversational Reply The remote station sent in a conversational reply to a data transfer. Repair Action : Contact far end operator and inform him of the failure. Determine if any far end problem exists which could explain this failure.

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9598	Remote protocol violation Limited reply The remote station sent in a limited reply to a data transfer. Repair Action : Contact far end operator and inform him of the failure. Determine if any far end problem exists which could explain this failure.
96A5	Request to Transmit Timeout (RLSD Timeout) System/38 attempted to transmit after line turnaround and far end station continued to transmit for 3.4 seconds (or 10 seconds if old SDLC ROS is installed). Repair Action : Verify that the Four Wire Line, Switched Network and Multipoint Network fields in the ND are correct for the line. Check the external communication cables.
9745	Continuous SYN received The IOC received SYN chars for more than 3 seconds Repair Action : Call the CE or PSR, the far end station is failing.
9765	Unexpected SYN Received On a tributary link the control station did not wait 2.6 seconds before transmitting after a previous transmission. Repair Action : Call the PSR, the far end operating system is failing.
A200	Unexpected 'SNRM' An SDLC 'SNRM' was received when already in normal response mode. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol.
A210	Unexpected disconnect received.

An SDLC disconnect was received by the secondary station IOM prior to receiving a deactivate physical unit request from the primary.

The secondary station IOM will:

- 1 Perform an "Abnormal Deactivate Physical Unit"
- 2 Send a message to MSCP indicating "Abnormal Disconnect Received" (and abnormal DACTPU performed)
- 3 Log the error

Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol.

A220

SDLC Frame Reject

A condition has occurred causing entry into command reject mode:

- Invalid SDLC control field
- Out of range SDLC sequence numbers
- I-frame with control field that doesn't allow information data.

An SDLC command reject has been sent to the Primary station.

Repair Action : Check far end to verify correctness. Contact far end operator and inform him of the failure and see if there are any failures that would cause a violation of SNA protocol.

A230

Unexpected DACTPU

A deactivate physical unit was received prior to receiving all DACTLUs.

The secondary station IOM will:

- 1 Perform an abnormal DACTPU
- 2 Send a message to MSCP indicating "Abnormal DACTPU" performed
- 3 Log the error

Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Confirm that the far end host parameters are configured

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	properly for this System/38.	A380	Switched Secondary Line Inactivity Disconnect Timeout
A240	Unexpected DACTLU A Deactivate logical unit was received prior to receiving an Unbind for the LU-LU session. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Confirm that the far end host parameters are configured properly for this System/38.		The adapter has not received an input frame on the line for the duration of the non productive receive timer value - OR - The adapter has not received a command from the IOM for 30 seconds when it is not currently working on a command. The switched line is disconnected to save tariff charges. Repair Action : Verify that the Retry values and Nonproductive Receive fields in the ND object are large enough. Confirm that the line parameters are configured correctly. Also check that the remote station is operating correctly. If the problem persists, call the PSR and indicate that VMC is failing.
A250	Unexpected ACTPU A second cold ACTPU was received prior to receiving a DACTPU The secondary station IOM will: 1 Perform a "Second Cold ACTPU" function 2 Send a message to MSCP indicating "Second Cold ACTPU Received" and requesting MSCP to validate the SSCP ID in the ACTPU. 3 Log the error. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Confirm that the far end host parameters are configured properly for this System/38.	B020	Incomplete download (5294 only) The download of EC data failed. Either the data from VMC is bad or the far end hardware is failing. Repair Action : Call the CE or PSR, either VMC or 5294 hardware is failing. The 5294 may be operational at base EC level.
A260	Unexpected ACTLU A second Cold Activate Logical Unit was received prior to receiving a Deactivate Logical Unit for the SSCP-LU session. Repair Action : Contact the far end operator to see if there are any failures that would cause a violation of SNA protocol. Confirm that the host parameters are configured properly for the System/38.	B021	Bad device configuration for download Repair Action : The CD has been configured as a 5251-12 but the far end station has responded by indicating that it is a 5294 and has requested download. This configuration error should be corrected, however, the 5294 is operational.
		B104	Received excessive negotiable XID responses Far end transmitted more than six negotiable XID responses, would not assume secondary SDLC role.

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	Repair Action : Contact far end operator to determine why secondary XID (format 3) is not being provided.		Repair Action : If user defined data, the Restore data may have been altered by the user. Otherwise, call the PSR or CE because the VMC or CPF software is failing.
B106	Received XID I-frame with error control vector(s).		
	Far end is identifying error(s) in XID we transmitted.	D021	SSD Save Area Invalid for Kanji device
	Repair Action : Contact far end operator to determine why XID is not compatible. If necessary, call PSR or CE to resolve.		A Save command was issued to a Kanji display, but no Save Area for the RAM Contents List is allocated in the SSR.
B108	Received XID I-frame with invalid data		Repair Action : If user defined data, the input buffer size may be too small. Otherwise, call the PSR or CE because the VMC or CPF software is failing.
	XID I-field data must be one of the following:	E2C4	RTS Inactive or RTS Dropped
	1. XID format 0		The RTS signal from the CA did not go active or was active and went inactive.
	2. XID format 1		Repair Action : Call the CE the hardware is failing.
	3. XID format 3 of valid length with no error control vector appended and one of the following:	E2E4	CTS active before RTS
	a) indicating negotiable SDLC role.		CTS found active for 3.4 seconds when initialize was attempted (BSC is timed - SDLC reports the error immediately).
	b) for SDLC ND, indicating secondary SDLC role, and additional I-field values meeting format check requirements.		Repair Action : Check the external communication cables and the modem. Try powering the modem down and up if it is a standalone modem. Verify that the Four Wire Line fields of the ND and MultipointNetwork are correct.
	c) for SDLC ND, indicating primary SDLC role, and additional I-field values meeting format check requirements.		
	4. For SDLC ND, not XID format 3.		
	Repair Action : Contact far end operator to determine why valid XID is not being provided.		
D019	Invalid RAM address on Kanji device		
	RAM address in input data stream from Kanji device does not match VMC tables or is out of range	E324	CTS Timeout or CTS Dropped
	Repair Action : Call the PSR or CE. The VMC or hardware is failing.		CTS did not become active within 3.4 seconds or CTS dropped during transmission.
D020	RAM Contents List Missing in SSD for Kanji device		Repair Action : Check the external communications cables and the modem. If this line has an external modem, try powering the modem down and up.
	A RESTORE command was issued to a Kanji display, but the RAM contents List is missing in the SSD when the RESTORE command is received by VMC.	E506	Reset ACU timeout

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	ACR, DSC, or PND remained active for 3.4 seconds. Repair Action : Check the ACU cables and the ACU. Try powering the ACU down and up.		Repair Action : Verify the cables to the autocal unit are good (jiggle the cables) and power the ACU down and up.
E526	Data Line Occupied Timeout Attempt to reset ACU failed and 'DLO' remained active for 3.4 seconds. Repair Action : Verify that the telephone (data set) is not in use for this communication line. If not call the CE, the hardware is failing.	E5E6	PND Timeout One or more digits transferred, waiting for PND, DPR inactive. Repair Action : Verify the cables to the autocal unit are good (jiggle the cables) and power the ACU down and up.
E546	'Abandon Call Retry' on ACU Call Request Repair Action : Verify that the telephone (data set) is not in use for this communication line. If not call the CE, the hardware is failing.	E606	'Distant Station Connected' Timeout No DSC signal received. Repair Action : Verify that the dial numbers are correct (check the Dial Digits field of the CD).
E566	PND timeout on first digit Repair Action : Verify the cables to the autocal unit are good (jiggle the cables) and power the ACU down and up.	E626	ACR Received, Waiting for DSC Repair Action : Verify that the dial numbers are correct (check the Dial Digits field of the CD).
E586	'Digit Present' Timeout PND did not drop. Repair Action : Verify the cables to the autocal unit are good (jiggle the cables) and power the ACU down and up.	F088	NAK to text or line bid The remote station sent a negative acknowledgement indicating the text was not received correctly or a NAK was received as response to a line bid. When this error code is returned, the machine has retried the error to the limit. Repair Action : Verify that the link is good. Check external communications cables. Call the CE, the hardware is failing.
E5A6	'Abandon Call Retry' on Digit Present ACR, 'Digit Present' Set Repair Action : Verify the cables to the autocal unit are good (jiggle the cables) and power the ACU down and up.	F108	Wrong ACK to text sent Repair Action : Verify that the link is good. Call the PSR, the far end is failing.
E5C6	ACR waiting for PND On initial 'Call Request' no PND received	F109	Wrong block sequence received The remote station sent the wrong block sequence count in the BCB. Repair Action : Call the PSR, the far end is failing.

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F288 ENQ received to text sent

Repair Action : Verify that the link is good. Call the PSR, the far end is failing.

a VMC failure has occurred which is allowing too many concurrent line operations.

F308 Protocol violation

The remote station is sending transmissions which do not adhere to MTAM or BSC protocol.

Repair Action : Call the PSR, the far end is failing or not in the proper protocol mode.

F507 Undefined SDLC Control Field

The far end station sent an invalid SDLC control field. (Possible only in SDLC primary mode. If in Secondary mode, this is reported as error code A220.)

Repair Action : Call the PSR the far end is failing.

F441 Data Overrun or Channel Disconnect

The IOC is unable to transfer data to main storage fast enough when receiving from the far end station.

Repair Action : The machine is over committed. Readjust the storage pool size.

F517 SDLC Sequence Error, Transmit Failure

The sequence numbers indicate that frames were lost on transmit. The far end station's frames received count is not coincident with our (System 38s) frames transmitted.

Repair Action : Verify that the link is good. Call the CE, the hardware is failing.

F481 Data Underrun or Channel Disconnect

Data from MS to the IOC was not available for transmit.

Repair Action : The machine is over committed. Readjust the storage pool size.

F527 SDLC Sequence Error, Receive Failure

The sequence numbers indicate that frames were lost on receive. Our number of frames received is not coincident with the far end station's number transmitted.

Repair Action : Verify that the link is good. Call the CE, the hardware is failing.

F488 ENQ to ACK sent

The remote station is not recognizing the acknowledgement sent by S/38.

Repair Action : Verify that the link is good. Call the PSR. The far end is failing or not in the proper protocol mode.

F660 MS Buffer Overrun

The number of bytes of data received before the ending sequence occurred exceeded the value in bytes 2-3 of the read data command. (The data received from the far end station is overflowing the input buffer.)

Repair Action : Verify that the link is good. Verify the ND object is correct, especially the Data Rate Select feature, Selected Rate, Nonclocked modem, BSC-Receive Timeout timer, and NRZI fields.

F4C2 Adapter Overrun or Adapter Underrun

The adapter card was not serviced by the IOC microcode within 1-byte time. The subsystem is running at a total data rate greater than 57.6 Kilo BPS.

Adapter Overrun

- On a receive operation, data is arriving too fast for the adapter.

Adapter Underrun

- On a transmit operation, the adapter cannot send data fast enough.

Repair Action : Call the CE, the hardware is failing or

F705 Idle State Detected

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The SDLC idle sequence (fifteen consecutive binary ones) was received. If operating in secondary mode, this error can only occur if the far end station stopped transmitting during I-frame transmission.

Repair Action : Verify that the link is good and that the far end is up. Verify the CD and ND objects are correct, especially the CD physical address field, and the role field (SDLC or SDLC), and the ND Idle State Detection timer, Data Rate Select feature, Selected Rate, Four Wire line, nonclocked modem and NRZI fields. Verify that the far end is configured and operating properly.

F725 Receive timeout data transfer state

A read command was issued and a time-out occurred because SYN characters were not present in a specified period of time.

Repair Action : Verify that the link is good. Verify the ND object is correct, especially the Data Rate Select feature, the Selected Rate, the Nonclocked Modem, the Four Wire line, and the BSC Receive Timer fields.

F735 Receive timeout, contention state

A read command was issued and a time-out occurred before a line bid was completed.

Repair Action : Verify that the link is good. Verify the ND object is correct, especially the Selected Rate, the Nonclocked Modem, the code (EBCDIC/ASCII) field, and the Four Wire line fields. Verify that the far end is configured and operating properly and compatible with the S/38

F765 Sync lost

Sync was established but was not maintained for a 3 second interval.

Repair Action : Verify that the link is good. Call the operator to verify the connections.

F7A5 Non-Productive Receive Timeout

The timer ended before a valid frame was received.

Repair Action : Verify that the link is good. Verify the ND object is correct, especially the Non-Productive Receive Timer, the NRZI, the Nonclocked Modem, the four-wire line, the multipoint indicator, and the Selected Rate fields. Verify far end configuration and operation. Check the local modem and the external communication cables.

F7C5 Frame Abort

The SDLC abort sequence ('01111111') was received.

Repair Action : Verify that the link is good. Verify the ND object is correct, especially the Selected Rate, the Nonclocked Modem, the multipoint field, and the Four Wire Line fields. Verify far end configuration and operation.

F7E5 Redundancy Check (VRC)

A parity error was detected in the received data.

Repair Action : Verify that the link is good.

F805 Redundancy Check (CRC/LRC)

There is a mismatch between the System/38 computed CRC and that sent by the station. Verify that the far end is configured and operating properly.

Error Code	Error Name Description Repair Action
---------------	--

Repair Action : Verify that the link

is good.

ACRONYMS

AA	Auto answer
ABI	Adapter Bus In
ABO	Adapter Bus Out
ALU	Arithmetic logical Unit
ACK	Acknowledgement
ACR	Abandon Call and Retry
ACTLU	Activate Logical Unit
ACTPU	Activate Physical Unit
ACU	Auto Call Unit
BCB	Block control byte
BSC	Binary Synchronous Communications
BSC T	Binary Synchronous Communications Tributary
BSTAT	Basic Status
CA	Communication Adapter
CNN	Connection
CRC	Cyclic Redundancy Check
CRTCUD	CPF Create Control Unit Description
CRTLIND	CPF Create Line Description
CTS	Clear to Send
DACTLU	Deactivate Logical Unit
DACTPU	Deactivate Physical Unit
DAF	Destination Address Field
DBI	Data Bus In
DFC	Data Flow Control
DPR	Digit Present Reset
DSC	Disconnect
DSR	Data Set Ready
DSTAT	Device Status
DTR	Data Terminal Ready
EOT	End of Transmission
FID	Format Identification
FMD	Function Management Data
FOB	Function Operation Block
INSTR	Instruction
IOC	Input Output Controller
IOM	Input Output Manager
LRC	Longitudinal Redundancy Check
MI	Machine Interface
MS	Main Storage
MSCP	Machine Service Control Point
NAK	Negative Acknowledgement
OAF	Origination Address Field
OP	Operation
ORE	Operation Request Element
OU	Operation Unit
PDP	Problem Determination Procedure
PND	Present Next Digit
RI	Ring Indicate
RLSD	Receive Line Signal Detect
RTS	Request to Send
ROS	Read only storage
SC	Session Control
SNRM	Set Normal Response Mode
SSCP ID	System Service Control Point Identification
VRC	Vertical Redundancy Check
XFR	Transfer

5.3.3 COMMUNICATIONS RECOVERY (EXCEPT APPC)

During the life of a connection errors may occur due to a failure of the device or the path that connects

them (Link/Station failures). For these type errors notification is given to the MI user via several events which require definite action in order to continue normal processing (establish the connection and contact the remote device). In addition to the events, error notification will also be given to the MI user via an error FBR response indicating the type of error. After the failure the machine will queue Activate Resource REQIO requests until the failure is corrected by PROGRAMMED retry or OPERATOR intervention. Whenever a REQIO(CONTINUE) instruction is issued the MI user may continue to execute and issue REQIOs until an access of the link is required or a FBR error code of '0018'X (no data) is received. However if an access of the link (transmit) is requested the REQIO would be returned with a FBR error code indicating the type of failure. The MI user must assure the necessary cleanup, Modify LUD Reset - Deactivate, has been performed prior to reuse (Activate Resource REQIO issued) of the device (LUD). Failure to do so may have unpredictable results due to pending data or REQIOs present when the failure occurs.

- Vary On Processing, Device Failures: These errors occur when a request to establish a connection or completion of the Vary On/Continue processing has failed for a leased line or notification is received that the device is inoperative. For these failures the recovery procedures initiated by the MSCP will cause the state/status transitions as described in section 5.3.3 for all associated objects. However, for all switched line connection failures the machine will perform the necessary recovery for the ND and CD objects, where applicable, provided these failures were not a result of an inoperative line or station.
- Disconnect Normal/Abnormal: This condition occurs when a "DISC or RD" is received from the remote station. For these conditions the recovery procedures initiated by the MSCP will cause the state/status transitions as described in section: 5.3.3 for all associated objects. The Active LUDs do not attain the state of the CD with which they are associated but remain in the state attained prior to the failure to allow the error notification to be sent for all active LUDs.
- Device Unavailable: This condition occurs when, the ACTLU has not been received or a DACTLU "Normal" is received from the Primary LU, a LUSTAT "Device Unavailable" or a "Device Unavailable" response for ACTLU is received from the local or remote Workstation. For these conditions the recovery procedures initiated by the MSCP will cause the state/status transitions as described in section 5.3.3.
- Inoperative: When notification is received from the IOM that an unrecoverable error has occurred the recovery procedures initiated by the MSCP will cause the state transition as described in section 5.3.3

for all associated objects. The Active LUDs do not attain the state of the CD with which they are associated but remain in the state attained prior to the failure to allow the error notification to be sent for all active LUDs.

- Function Checks Assignable to the MI User Data: These errors, SSD and Queue destroyed, are recoverable by the IOM and the associated LUD is not placed in an ERP state. It must be recognized that these errors may cause the OU tasks to fail and will require Recovery to the extent that they be placed in an operational state where the transmission and receipt of data from the Link will occur when the Recovery is complete.
- Partial System Object Damage: These errors are not recoverable by the MSCP due to the inability to discover where the error occurred or how, under MSCP control, to bypass or correct the error to the point where the IOM/OU Tasks are capable of performing a useful function. Recovery for these errors are limited in scope, due to the nature of the failure, and is accomplished thru the following procedures:
 - The necessary VLOG Dumps of the IOM and OU tasks are taken and the tasks destroyed.
 - Will cause the State/Status transition as described in section: 5.3.3 for the associated object(s).
 - For recovery the MI user must Vary Off the associated object(s).

5.3.3.1 Recovery/Restart Procedures

Inoperative Pending (Link/Station): The MI user must provide the capability to activate the link, MODIFY ND (Continue), represented by the ND that incurred the error. The MI user must also issue a MODIFY CD (Continue) instruction for each Controller (CD) to direct the MSCP to establish contact with the appropriate remote Station and reinitiation of the Logical Unit. The connection is established when for a switched network an incoming call is received, an explicit request (MODIFY CD Dial) to dial out is made or the remote Station is Contacted on a leased line. The MSCP will validate the request and complete the processing as described in Section 5.3.3 for the "Modify CD (Continue)" MI Instruction support.

Normal Pending (MTAM Leased Network): The MI user must provide the capability to activate the station, MODIFY CD (Continue), represented by the CD that incurred the Disconnect, to direct the MSCP to establish contact with the appropriate remote Station and reinitiation of the Logical Unit. To accomplish this the Primary Intervention event (0004,06,04) is signaled when a Activate Resource

REQIO is the first received for any LUD attached to a VARIED ON PENDING CD with the Recovery Activation status area indicating NORMAL PENDING. The MSCP will validate the request and complete the processing as described in Section 5.3.3 for the "Modify CD (Continue)" MI Instruction support.

Inoperative Pending (Device): The MI user must provide the capability to reinitiate the device, MODIFY LUD (Continue), represented by the LUD that incurred the error. The MSCP will complete the processing as described in Section 5.3.3 for the "Modify LUD (Continue)" MI Instruction support.

For recovery failures, the MI user is not able to correct the error, a supervisory request for the ND, MODIFY ND (Cancel), for each Controller, MODIFY CD (Cancel) or for each device, MODIFY LUD (Cancel), must be issued in order to propagate the error to any pending Activate Resource REQIOs and suspend any reactivation attempts.

5.3.3.2 Communications Recovery MI Interface

This section describes the programming considerations and specific support requirements for communications recovery. Communications with the remote Device after error notification is accomplished through the following MI command support.

- MODND Recovery/Activation Status:
 - Cancel
 - Continue
- MODCD Recovery/Activation Status:
 - Cancel
 - Continue
- MODLUD Recovery/Activation Status:
 - Cancel
 - Continue

Only the following object types support these Communications Recovery MI commands.

- Controller Description (CD).
 - Type-00 Local Workstation (WSC,WSCE) only.
 - Type-10 Remote Workstation (5251, 5291, 5292, 327X, 5294), BISYNC, MTAM, PU2 only.
- Logical Unit Description (LUD).
 - Type-10 Local Workstation (5251, 5252, 5291, 5555, 5292, 5256, 5224, 5225, 5553) only.
 - Type-30 Remote Workstation (5251, 5252, 5291, 5292, 5256, 5224, 5225, 327X), BISYNC, MTAM, LU-1 only.
- Network Description (ND).

- Type-00 SDLC Primary (Remote Workstation), BISYNC, MTAM, SDLC Secondary (LU-1) only.

Each of the modifiable elements within the Recovery/Activation status area can only be successfully modified subject to the status indicated within the object. If the status is such that modification of the requested element cannot be allowed, a S/S Object State invalid exception is signaled. Refer to the figures described in the following sections for each object for a description of the status which exists and the valid changes which can be made using the MODIFY Continue/Cancel options.

Any modification options that involve a change to the objects while using the Recovery Activation status element modification option, will result in an Template Value Invalid exception being signaled and the modification of the object is stopped at that point.

When a CD (Leased Network only) or LUD is being explicitly Varied On using the Modify CD/LUD instruction and the resource is not available due to failures (status indicates "Inoperative Pending") or Canceled (status indicates "Cancel") being set prior to the Vary On, the object status for the CD is set to the status of the ND and for the LUD the status is set to the status of the CD.

Modifications of the S/S objects for operations involving the Recovery/Activation status area are not ensured by object locks and may be changed independently by another process even though they are locked "exclusive".

This command is used to suspend the reconnection and reuse of the communications line and is accomplished thru the Recovery/Activation indicators contained within the objects. The "Cancel" status is set in the ND and for a leased network all attached CD(s) and their associated LUD(s) provided they are not in the VARIED OFF state.

MODND (CONTINUE)

This command is used to enable (allow) the reuse of the line after an unrecoverable error has occurred and is accomplished thru the Recovery/Activation indicators contained within the ND object. The "Continue" status is set for the ND object only regardless of the network connect method.

During the CONTINUE processing as part of MODIFY ND, the MSCP is requested to activate the link represented by this ND. Activation of the link includes all the logical and physical initialization required before a remote station on that link can be contacted. When the ND is for a leased line the line is prepared for transmitting to the attached station. When the ND being activated represents a connection into the switched network, that communications adapter is initialized and prepared for calls. Its usage is governed by the option specified in the Switched Connect Method field. If "Dialin" is specified, the link is activated for incoming calls. If "Dialout" is specified, the link is activated for outgoing calls. If "Either dialin or dialout" is specified, the link is activated for incoming calls. Should it be necessary to use this facility for a dial out call before a dial in has occurred, the resource is available and can be so allocated.

5.3.3.3 Modify/Materialize Network Description (MODND)

MODND (CANCEL)

ND Modify/Materialize Template

	Element Length	Sub Element Length	Modify Option Value	Materialize Option Value
• State/Status Definition	Char(16)		4001	Z001
- State Change/Status		Char(6)		
Bytes 0-1 --- - MAT - ND Active Count MOD - Reserved		Bin(2)		
Byte 2 --- Bit 0 - MAT - Network Active MOD - Reserved		Bit(1)		
Bit 1 - MAT - Manual Dial Start State MOD - Abandon Call		Bit(1)		
Bit 2 - MAT - Manual Answer Start State MOD - Manual Start Data Command		Bit(1)		
Bit 3 - MAT - Manual Answer State MOD - Manual Answer Command		Bit(1)		
Bit 4 - MAT - Dial Pending State MOD - Disable Command		Bit(1)		
Bit 5 - MAT - Switched Enable State MOD - Enable Command		Bit(1)		
Bit 6 - MAT - Varied On State MOD - Vary On Command		Bit(1)		
Bit 7 - MAT - Varied Off State MOD - Vary Off Command		Bit(1)		
Byte 3 Bit 0 - MAT - Diagnostic Mode MOD - Set Diagnostic Mode		Bit(1)		
Bit 1 - MAT - Diagnostic Active Indicator MOD - Reset Diagnostic Mode		Bit(1)		
Bits 2-7 - Reserved		Bit(6)		
Bytes 4-5 --- Reserved		Char(2)		
- Recovery/Activation Definition		Char(2)		
Byte 0 --- Bit 0 - MAT - Inoperative Pending MOD - Reserved		Bit(1)		
Bit 1 - Reserved		Bit(1)		
Bit 2 - MAT - Normal Cancel MOD - Cancel		Bit(1)		
Bit 3 - MAT - Normal Continue MOD - Continue		Bit(1)		
Bits 4-6 - Reserved		Bit(2)		
Bit 7 - MAT - Normal Active MOD - Reserved		Bit(1)		
Byte 1 - Reserved		Char(1)		
- Reserved		Char(8)		

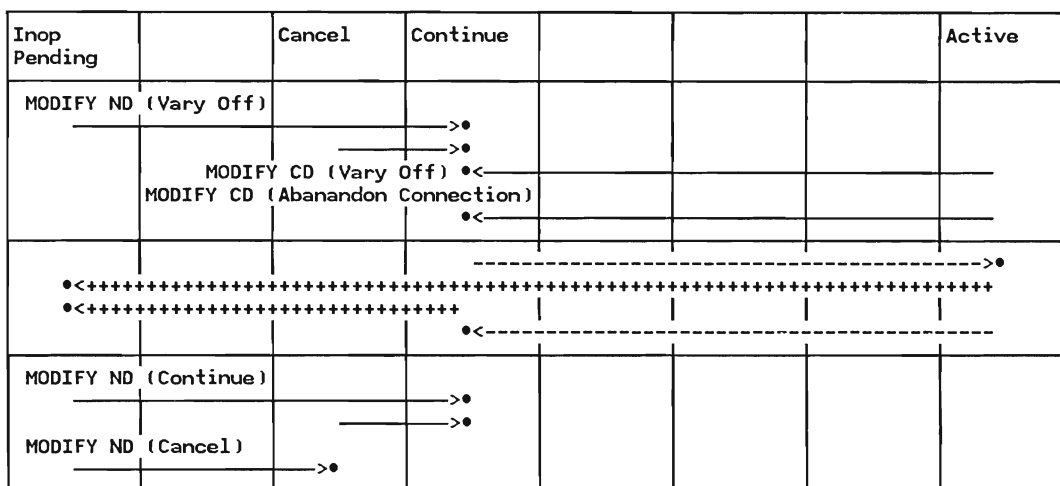
- <--> State transition caused by successful completion of S/S Modify instruction.
- ---> State transition asynchronous to the S/S instruction. Notification of this state change is given via the following events:
 - 0004,04,01 CD Contact Successful.
- <+++ State transition asynchronous to the S/S instruction caused by a failure. Notification of this state change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful "For a Switched Line".
 - 0004,05,01 CD Failure "For a Switched Line".
 - 000E,04,01 ND Connection Failure "Manual Answer only".
 - 000E,04,02 ND Connection Failure "Manual Answer only".
 - 000E,04,03 ND Connection Failure "Manual Answer only".
 - 000E,05,01 ND Line Failure "For a Switched Line".
- NOTE: Any events not specified will not result in a State transition.

ND STATE CHANGE RULES

Allowable States for Modification									
Modify Instruction	Diagnostic Mode	Varied Off	Varied On	Switched Enabled	Dial Pending	Manual Answer	Manual Answer Start Data	Manual Dial Start Data	Network Active
Vary On	NO	YES	NO	NO	NO	NO	NO	NO	NO
Enable	NO	NO	YES	NO	NO	NO	NO	NO	NO
CD Dial	NO	NO	NO	YES	NO	NO	NO	NO	NO
Manual Answer	NO	NO	NO	YES	NO	NO	NO	NO	NO
Manual Start Data	NO	NO	NO	NO	YES	YES	NO	NO	NO
Abandon Call	NO	NO	NO	NO	NO	YES	YES	NO	NO
Disable	NO	NO	NO	YES	NO	NO	NO	NO	NO
CD Abandon Connection	NO	NO	NO	NO	YES	NO	NO	YES	YES
Vary Off	NO	NO	YES	NO	NO	NO	NO	NO	NO
Cancel	NO	NO	YES-(1)	YES	NO	NO	NO	NO	YES-(1)
Continue	NO	NO	YES-(1)	YES	NO	NO	NO	NO	YES-(1)

- -(1) Modification for a Leased Line only; Otherwise "NO".

ND OBJECT RECOVERY/ACTIVATION STATUS TRANSITIONS



- <==> Status transition caused by successful completion of S/S Modify instruction.
- ---> Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,01 CD Contact Successful.
- <--- Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful "For a Switched Line".
 - 0004,04,03 CD Loss of Contact.
 - 0004,05,01 CD Failure "For a Switched Line".
- <+++ Status transition asynchronous to the S/S instruction caused by a failure. Notification of this status change is given via the following events:
 - 000E,05,01 ND Line Failure.
 - 0017,08,01 Partial System Object Damage set.
- NOTE: Any events not specified will not result in a Status transition.

ND STATUS CHANGE RULES

	Allowable Status for Modification			
Modify Instruction	Inop Pending	Cancel	Continue	Active
Vary on	NO	NO	YES	NO
Enable	YES	YES	YES	NO
CD Dial	NO	NO	YES	NO
Manual Answer	NO	NO	YES	NO
Manual Start Data	NO	NO	YES	NO
Abandon Call	NO	NO	YES	NO
Disable	YES	YES	YES	NO
CD Abandon Connection	NO	NO	YES	NO
Vary Off	YES	YES	YES	NO
Cancel	YES	NO	NO	NO
Continue	YES	YES	NO	NO

5.3.3.4 Modify/Materialize Controller Description (MODCD)

MODCD (CANCEL)

This command is used to suspend the reconnection and reuse of the CD and is accomplished thru the Recovery/Activation indicators contained within the CD and LUD objects. The Cancel status is set in the CD and attached LUD(s) provided they are not in the VARIED OFF state. In addition any pending Activate Resource REQIOs are returned with a FBR error code indicating the Canceled condition.

MODCD (CONTINUE)

This command is used to enable (allow) the reuse of the Controller and request the MSCP to establish contact again after an unrecoverable error has occurred. This is accomplished thru the Recovery/Activation indicators contained within the CD and LUD objects. The Continue status is set for the CD and all associated LUD(s) provided the attached LUD(s) are not in the VARIED OFF state. However, when Activate Resource REQIOs are present (Queued) the Activation Pending status is set for the associated LUD(s). The following sequence describes the processing of the MODIFY CD (Continue) instruction:

- When the CD represents a remote Station using the switched network facilities and an Activate Resource REQIO is present for any attached LUD, the switched Intervention event (0004,06,03) is signaled. However, when an Activate Resource REQIO is not present (queued) for any of the LUD(s) associated with this Controller the CD remains in the VARIED ON PENDING state, the event is not signaled, and physical contact will not be made until an incoming call is received.
- When the remote Station is contacted the CD is brought to the VARIED ON state and the CD Contact event (Successful) is signaled.
- The CD object is set to the ACTIVE LUD(s) VARIED ON state whenever the first LUD attached to this controller completes the Vary On processing being performed by the MSCP.

- The CD object is set to the ACTIVE LUD(s) ACTIVE state whenever the first LUD attached to this controller completes the asynchronous LUD Vary On processing being performed by the MSCP and the LUD state indicates the RESET, QUIESCE, SUSPEND, or ACTIVE SESSION state or a Modify LUD Activate Session is issued.

The network resources are allocated and the connection established as a result of an incoming call being received, an explicit request (MODIFY CD-DIAL) to dial out is initiated by an MI process or the remote Station is varied on line. Upon completion of the connection, the MSCP receives the Exchange ID (XID) or SSCPID information as sent by the remote Station. The MSCP validates the identity of the far end Station and completes the processing based on the following checks:

- The Exchange ID matches the Exchange ID field, or the SSCPID matches the SSCPID in a Controller Description.
- The CD object indicates the VARIED ON PENDING state.
- The ND representing the line on which the call is made is included in the ND candidate list of this CD.

To put it another way: the remote PU must be known to the system, must not be VARIED OFF and must be allowed to use this line. If any of these checks fail, the connection is broken and the appropriate MI event is signaled.

MODCD (ABANDON CONNECTION)

This command is used to allow the remote PU to be disconnected. This command WILL NOT:

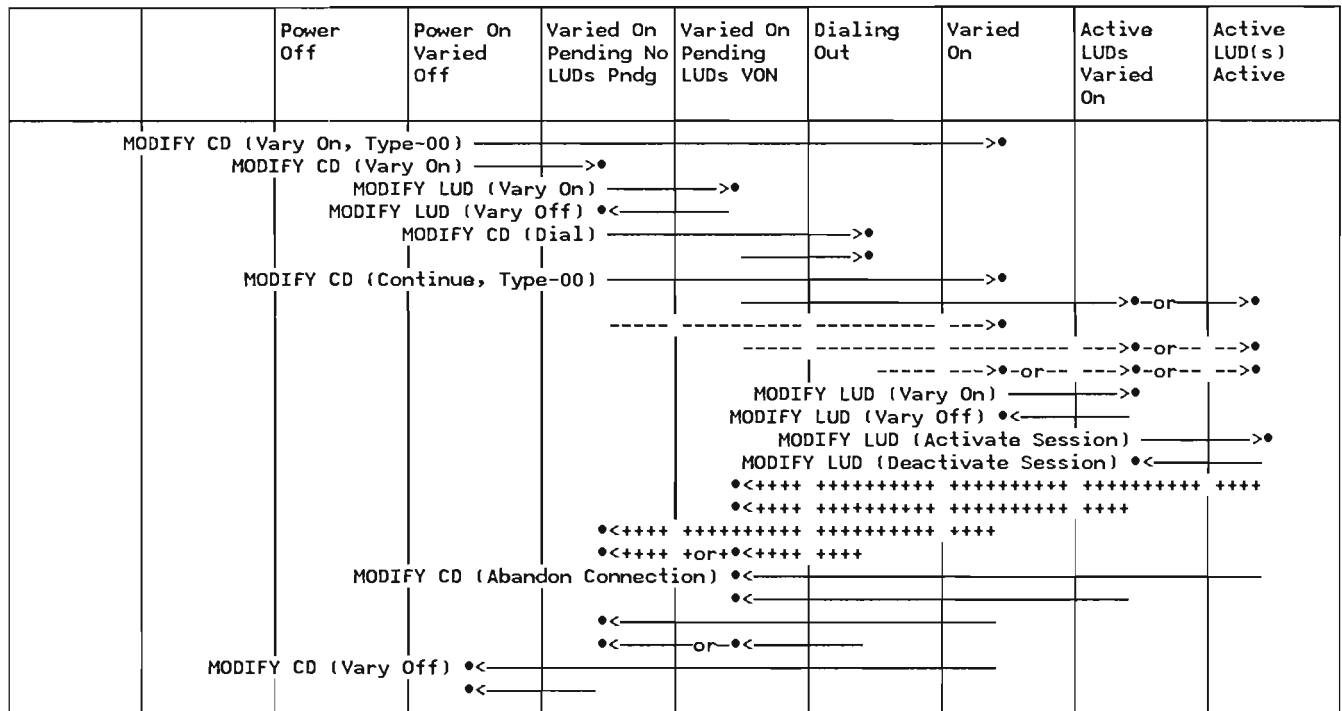
- Cause the Activate Resource REQIOs to be returned to the user's return queue.
- Cause a state transition for any of the attached LUDs that indicate the RESET, QUIESCED, SUSPENDED, or ACTIVE SESSION state. This is due to the operational characteristics of the Communication Recovery support that allows the MI users to wait for the connection to be reestablished or to process data without having the need for a connection.

CD Modify/Materialize Template

	Element Length	Sub Element Length	Modify Option Value	Materialize Option Value
• State/Status Definition	Char(16)		4001	Z001
- State Change/Status		Char(6)		
Bytes 0-1 --- - MAT - CD Session Count MOD - Reserved		Bin(2)		
Bytes 2-3 --- - MAT - CD Active Count MOD - Reserved		Bin(2)		
Byte 4 --- Bit 0 - MAT - LUDs in Session MOD - Reserved		Bit(1)		
Bit 1 - MAT - LUDs Varied On MOD - Reserved		Bit(1)		
Bit 2 - MAT - Varied on State MOD - Dial Command		Bit(1)		
Bit 3 - MAT - Dialing Out State MOD - Abandon Connection		Bit(1)		
Bit 4 - MAT - Vary On Pending, LUDs Pending MOD - Reserved		Bit(1)		
Bit 5 - MAT - Vary On Pending State MOD - Vary On Command		Bit(1)		
Bit 6 - MAT - Reserved MOD - Vary Off Command		Bit(1)		
Bit 7 - MAT - Power On/Vary off State MOD - Power On Command		Bit(1)		
Byte 5 Bit 0 - MAT - Power Off State MOD - Power Off Command		Bit(1)		
Bits 1-3 - Reserved		Bit(3)		
Bit 4 - MAT - Diagnostic Mode MOD - Set Diagnostic Mode		Bit(1)		
Bit 5 - MAT - Diagnostic Active Indicator MOD - Reset Diagnostic Mode		Bit(1)		
Bits 6-7 - Reserved		Bit(2)		
- Recovery/Activation Definition		Char(2)		
Byte 0 --- Bit 0 - MAT - Inoperative Pending MOD - Reserved		Bit(1)		
Bit 1 - MAT - Normal Pending MOD - Reserved		Bit(1)		
Bit 2 - MAT - Normal Cancel MOD - Cancel		Bit(1)		
Bit 3 - MAT - Normal Continue MOD - Continue		Bit(1)		

Bit 4 - MAT - Normal Activation	Bit(1)
Pending	
MOD - Reserved	
Bits 5-6 - Reserved	Bit(1)
Bit 7 - MAT - Normal Active	Bit(1)
MOD - Reserved	
Byte 1 - Reserved	Char(1)
	Char(8)

CD OBJECT STATE TRANSITIONS



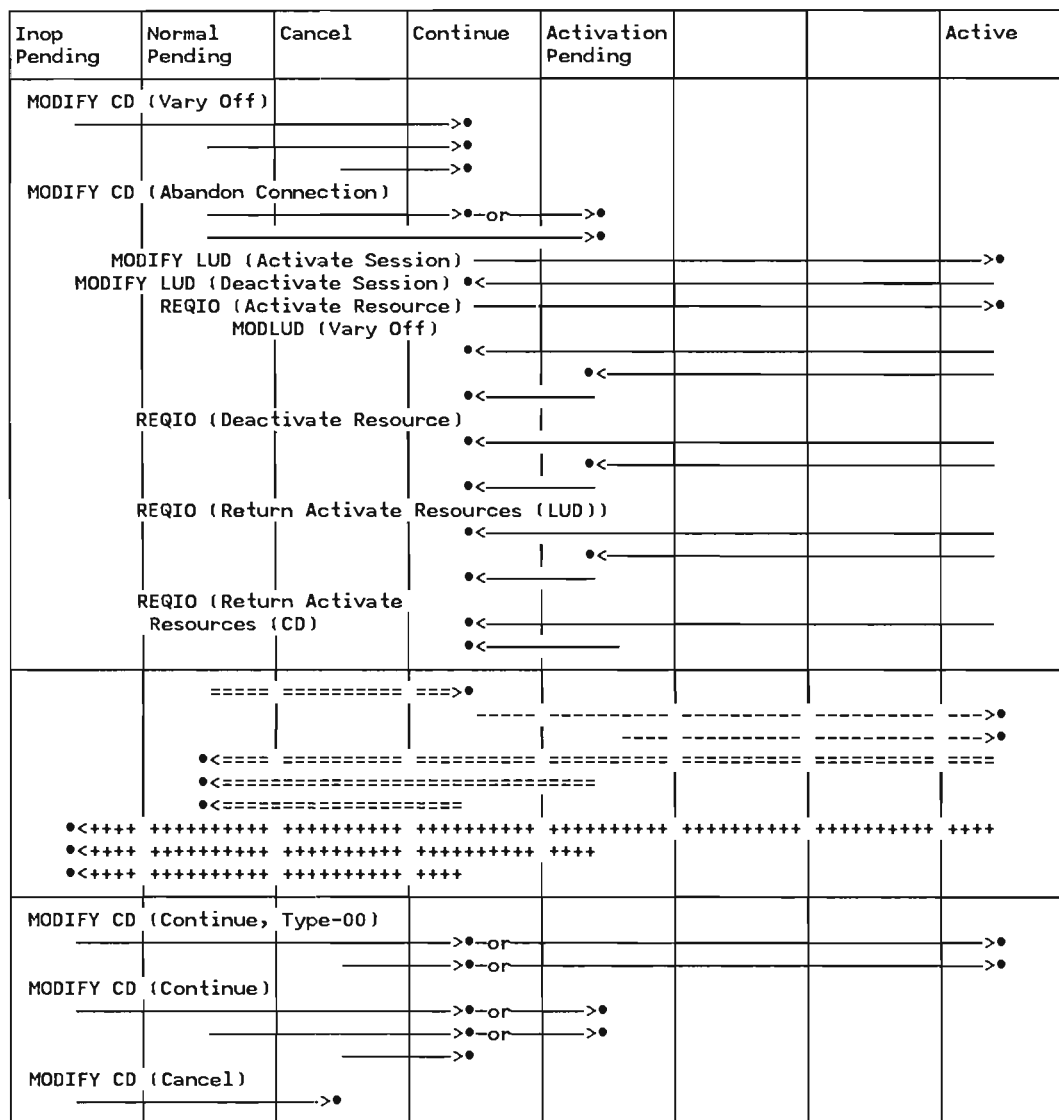
- <—> State transition caused by successful completion of S/S Modify instruction.
- ---> State transition asynchronous to the S/S instruction. Notification of this state change is given via the following events:
 - 0004,04,01 CD Contact Successful.
- <+++ State transition asynchronous to the S/S instruction caused by a failure. Notification of this state change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful.
 - 0004,05,01 CD Failure.
 - 000E,05,01 ND Line Failure.
- NOTE: Any events not specified will not result in a State transition.

CD STATE CHANGE RULES

Allowable States for Modification									
Modify Instruction	Diagnostic Mode	Power Off	Power On Varied Off	Varied On Pending No LUDs Pndg	Varied On Pending LUDs VON	Dialing Out	Varied On	Active LUDs VON	Active LUD(s) Active
Vary On	NO	NO	YES	NO	NO	NO	NO	NO	NO
LUD Vary On	NO	NO	NO	YES	YES	YES	YES	YES	YES
LUD Activate Session	NO	NO	NO	NO	YES-(1)	YES-(1)	NO	YES	YES
Dial	NO	NO	NO	YES	YES	NO	NO	NO	NO
Abandon Connection	NO	NO	NO	NO	NO	YES	YES	YES	YES
LUD Vary Off	NO	NO	NO	NO	YES	YES	NO	YES	YES
LUD Deactivate Session	NO	NO	NO	NO	YES	YES	NO	NO	YES
Vary Off	NO	NO	NO	YES	NO	NO	YES	NO	NO
Cancel	NO	NO	NO	YES	YES	NO	NO	NO	NO
Continue	NO	NO	NO	YES	YES	NO	YES-(2)	YES-(2)	YES-(2)

- -(1) Modification for Local/Remote Workstation, LU-1 only; Otherwise "NO".
- -(2) Modification for a leased line (MTAM only); Otherwise "NO".

CD OBJECT RECOVERY/ACTIVATION STATUS TRANSITIONS



- <—> Status transition caused by successful completion of S/S Modify or Synchronous REQIO instruction.
- ---> Status transition asynchronous to the S/S instruction caused by the Activate Resource REQIO being returned to the Request I/O MI Response queue or the LUD state is Reset, Suspended, Quiesced or Activate Session when the asynchronous Vary On LUD processing completes. Notification of this status change is given via the following events:
 - 0004,04,01 CD Contact Successful.
 - 0008,06,01 LUD Contact Successful.
- <=== Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,03 CD Loss of Contact.

- ==> Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,01 CD Contact Successful "For a Leased Line (LU-1 only)".
- <+++ Status transition asynchronous to the S/S instruction caused by a failure. Notification of this status change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful "For a Leased Line except for reason code 0005".
 - 0004,05,01 CD Failure.
 - 000E,05,01 ND Line Failure.
 - 0017,08,01 Partial System Object Damage set.
- NOTE: Any events not specified will not result in a Status transition.

CD STATUS CHANGE RULES

Modify Instruction	Allowable Status for Modification					
	Inop Pending	Normal Pending	Cancel	Continue	Activation Pending	Active
Vary On	NO	NO	NO	YES	NO	NO
LUD Vary On	YES	YES	YES	YES	YES	YES
LUD Activate Session	YES-(1)	YES-(1)	YES-(1)	YES	YES	YES
Dial	NO	NO	NO	YES	YES	NO
Abandon Connection	NO	YES	NO	YES	YES	NO
LUD Vary Off	YES	YES	YES	YES	YES	YES
LUD Deactivate Session	YES	YES	YES	YES	YES	YES
Vary Off	YES	YES	YES	YES	NO	NO
Cancel	YES	NO	NO	NO	NO	NO
Continue	YES	YES-(2)	YES	NO	YES-(3)	NO

- -(1) Modification for Local/Remote Workstation, LU-1 only; Otherwise "NO".
- -(2) Modification for a leased line (MTAM only); Otherwise "NO".
- -(3) Modification for a leased line (MTAM only) and normal pending status indicated along with activation status; otherwise "NO".

5.3.3.5 Modify/Materialize Logical Unit Description (MODLUD)

MODLUD (CANCEL)

This command is used to suspend the device and sets the "Cancel" status in the Recovery/Activation area contained in the LUD and any pending Activate Resource REQIOs are returned with a FBR error indicating the Canceled condition.

MODLUD (CONTINUE)

This command is used to enable (allow) the reuse of the device after an unrecoverable error has occurred and sets the "Continue" status in Recovery/Activation area contained in the LUD. However, when Activate Resource REQIOs are present (Queued) the Activation Pending status is set for the associated LUD.

A LUD representing a Logical Unit associated with a remote Station on a leased line, or a remote Station using the switched network facilities, do not attain the state of the CD with which they are associated but remain in the state attained prior to the failure.

The MSCP will complete the Pending Continue function as described below and return all pending Activate Resource REQIOs.

- Local/Remote Workstation, LU-1 LUDs: The Logical Unit Description event Class X'000B', Type 6, Subtype 1, (LUD Contact Successful) is signaled, when the connection is established and a positive response to ACTLU with device available indication has been received or sent.

- BISYNC, MTAM LUDS: The Logical Unit Description event Class X'000B', Type 6, Subtype 1, (LUD Contact Successful) is signaled, when the connection is established.

MODLUD (VARY OFF)

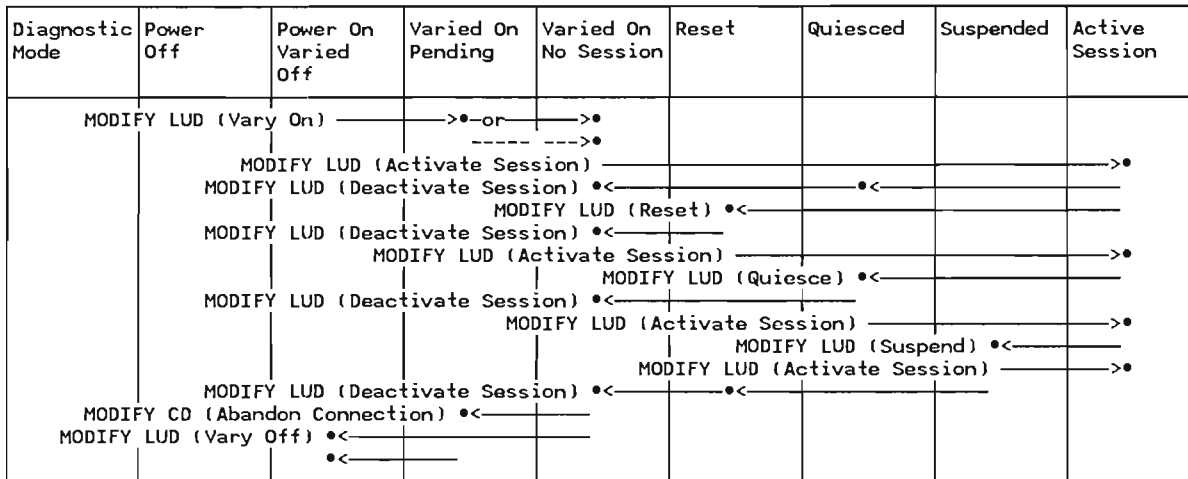
This command is used to deactivate the MSCP-LU path and return all pending Activate Resource REQIOs with a FBR error indicating the Varied Off condition.

LUD Modify/Materialize Template

	Element Length	Sub Element Length	Modify Option Value	Materialize Option Value
• State/Status Definition	Char(16)		4001	Z001
- State Change/Status		Char(6)		
Byte 0 --- Bits 0-6 - Reserved		Bit(7)		
Bit 7 - MAT - Active Session State MOD - Activate Session		Bit(1)		
Bytes 1 --- Bit 0 - MAT - Suspend Session State MOD - Suspend Session		Bit(1)		
Bit 1 - MAT - Quiesced Session State MOD - Quiesce Session		Bit(1)		
Bit 2 - MAT - Reset Session State MOD - Reset Session		Bit(1)		
Bit 3 - MAT - Varied On/No Session State MOD - Deactivate Session		Bit(1)		
Bit 4 - MAT - Vary On Pending State MOD - Vary On Command		Bit(1)		
Bit 5 - MAT - Reserved MOD - Vary Off Command		Bit(1)		
Bit 6 - MAT - Power On/Vary Off State MOD - Power On Command		Bit(1)		
Bit 7 - MAT - Powered Off State MOD - Power Off Command		Bit(1)		
Byte 2 Bit 0 - MAT - Diagnostic Mode MOD - Set Diagnostic Mode		Bit(1)		
Bit 1 - MAT - Diagnostic Active Indicator MOD - Reset Diagnostic Mode		Bit(3)		
Bits 2-7 - Reserved		Bit(6)		
Bytes 3-5 --- Reserved		Char(3)		
- Recovery/Activation Definition		Char(2)		
Byte 0 --- Bit 0 - MAT - Inoperative Pending MOD - Reserved		Bit(1)		
Bit 1 - MAT - Normal Pending MOD - Reserved		Bit(1)		
Bit 2 - MAT - Normal Cancel MOD - Cancel		Bit(1)		
Bit 3 - MAT - Normal Continue MOD - Continue		Bit(1)		
Bit 4 - MAT - Normal Activation Pending MOD - Reserved		Bit(1)		

Bit 5	- Reserved	Bit(1)
Bit 6	- Reserved	Bit(1)
Bit 7 - MAT	- Normal Active	Bit(1)
MOD	- Reserved	
Byte 1	- Reserved	Char(1)
- Reserved		Char(8)

LUD OBJECT STATE TRANSITIONS

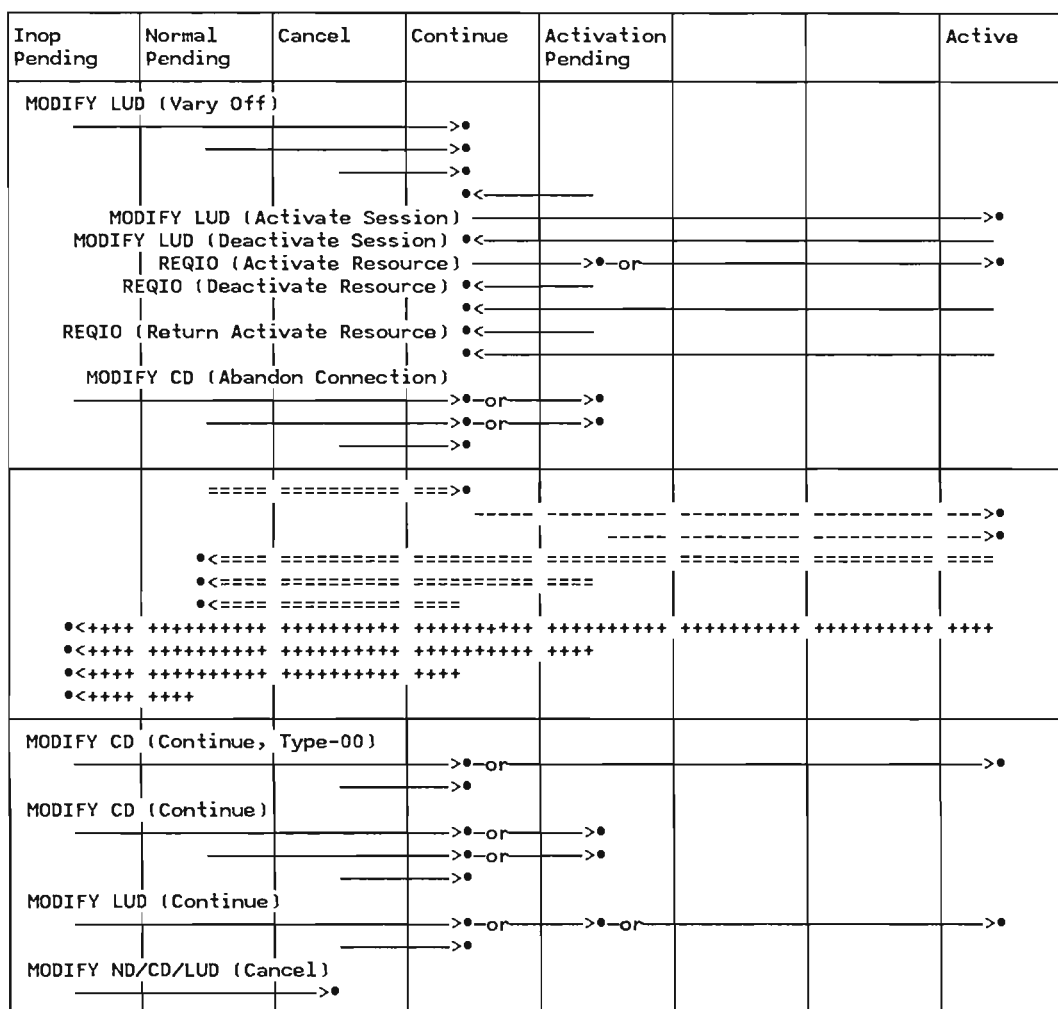


- <—> State transition caused by successful completion of S/S Modify instruction.
- ---> State transition asynchronous to the S/S instruction and Activate Resource REQIOs returned with good FBR status. Notification of this state change is given via the following events:
 - 000B,06,01 LUD Contact Successful.
- NOTE: Any events not specified will not result in a State transition.

LUD STATE CHANGE RULES

Allowable States for Modification									
Modify Instruction	Diagnostic Mode	Power Off	Power On Varied Off	Varied On Pending	Varied On No Session	Reset	Quiesced	Suspended	Active Session
Vary On	NO	NO	YES	NO	NO	NO	NO	NO	NO
Reset	NO	NO	NO	NO	NO	NO	NO	NO	YES
Quiesce	NO	NO	NO	NO	NO	NO	NO	NO	YES
Suspend	NO	NO	NO	NO	NO	NO	NO	NO	YES
Activate Session	NO	NO	NO	NO	YES	YES	YES	YES	NO
Deactivate Session	NO	NO	NO	NO	NO	YES	YES	YES	YES
CD Abandon Connection	NO	NO	YES	YES	YES	YES	YES	YES	YES
Vary Off	NO	NO	NO	YES	YES	NO	NO	NO	NO
Cancel	NO	NO	NO	YES	YES	YES	YES	YES	YES
Continue	NO	NO	NO	YES	YES	YES	YES	YES	YES

LUD OBJECT RECOVERY/ACTIVATION STATUS TRANSITIONS



- <==> Status transition caused by successful completion of S/S Modify instruction or Asynchronous REQIO instruction.
- ---> Status transition asynchronous to the S/S instruction caused by the Activate Resource REQIO being returned to the Request I/O MI Response queue or the LUD state is Reset, Suspended, Quiesced or Activate Session when the asynchronous Vary On LUD processing completes. Notification of this status change is given via the following events:
 - 000B,06,01 LUD Contact Successful.
- <=== Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - LUD Vary On "ACTLU Device Unavailable response; ACTLU not received (LU-1 only)".
 - Modify LUD(Vary On) For a LUD attached to PASSTHRU CD
 - 000B,08,02 LUD Device Failure "Device Not Available".
 - 000B,08,03 LUD Device Failure "SSCP-LU Session Inactive".
 - 0004,04,03 CD Loss of Contact.
- ===> Status transition asynchronous to the S/S instruction.
 - LUD Vary On "ACTLU Device Available response".
 - LUD Vary On "ACTLU received (LU-1 only)".
 - 0004,04,01 CD Contact Successful "For a Leased Line (LU-1 only)".
- <+++ Status transition asynchronous to the S/S instruction caused by a failure. Notification of this status change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful "For a Leased Line except for reason code 0005".
 - 0004,05,01 CD Failure.
 - 000B,06,02 LUD Contact Unsuccessful "Error codes; '0001'x, and '0002'x".
 - 000B,08,01 LUD Device Failure.
 - 000E,05,01 ND Line Failure.
 - 0017,08,01 Partial System Object Damage set.
- NOTE: Any events not specified will not result in a Status transition.

LUD STATUS CHANGE RULES

Modify Instruction	Allowable Status for Modification					
	Inop Pending	Normal Pending	Cancel	Continue	Activation Pending	Active
Vary On	NO	NO	NO	YES	NO	NO
Reset	YES	YES	YES	YES	YES	YES
Quiesce	YES	YES	YES	YES	YES	YES
Suspend	YES	YES	YES	YES	YES	YES
Activate Session	YES	YES	YES	YES	YES	YES
Deactivate Session	YES	YES	YES	YES	YES	YES
CD Abandon Connection	YES	YES	YES	YES	YES	NO
Vary Off	YES	YES	YES	YES	YES	NO
Cancel	YES	NO	NO	NO	YES-(1)	NO
Continue	YES	NO	YES	NO	YES-(1)	NO

- -(1) Modification allowed if Inoperative Pending status indicated along with Activation Pending status; Otherwise "NO".

5.3.3.6 MSCP REQIO SUPPORT

The MSCP coordinates all supervisory service requests but does not necessarily provide the requested functions. That is, all supervisory service requests are sent to the MSCP, but the MSCP may in turn route the request on to the ultimate request processor. The MSCP can communicate with all LUs and PUs that are VARIED ON (varied on pending or higher state) via the MSCP-LU or MSCP-PU sessions. The REQUEST I/O instruction, with the function field in the SSR set to indicate an MSCP message, is used by the MI process to route the request to the MSCP. As before, the MSCP is responsible for routing the message to the appropriate destination. However, when requests are initiated by or destined for an MI process a different means of communication is required.

The MI process that issues supervisory service requests must communicate with the MSCP via the REQIO instruction. The MSCP-LU or MSCP-PU sessions are accessible to the MI process by using the MSCP REQIO with the SSR object pointer addressing the appropriate LUD or CD.

These commands are used to perform the supervisory services functions on the MSCP-To-LU flow. These supervisory service functions include:

- Default Operations (SSCP-LU)
- RECFMS 00 Alert Operations (SSCP-PU)
- Return RECFMS 00 Alerts
- Activate Resource
- Deactivate Resource
- Return Activate Resource

MSCP ASYNCHRONOUS SOURCE/SINK REQUEST (SSR)

The SSR must contain a system pointer to a LUD or CD, a system pointer to an MI response queue, and optionally a space pointer to the data in an SSD. The function field in the SSR is used to identify the REQIO as being directed to the MSCP.

The LUD or CD need not be in active session state when the REQIO is executed. The MSCP session, MSCP-LU or MSCP-PU are implicitly activated when the LUD or CD is VARIED ON. Therefore, a REQIO using these sessions is valid anytime the LUD or CD is in the VARIED ON PENDING or higher state.

The pointer to the SSD space is used the same as for a normal REQIO. That is, it provides addressability to the optional input or output data buffers as required by the RD fields in the SSR. The use of the SSD space on the MSCP sessions follows the same rules as defined for REQIO on the LU-LU session.

For all REQIO's with Request Control Fields containing '10'X or '20'X, the offset for the REQIO Variable Parameters must contain a valid value that

is not zero and falls within the SSR template space. A Template Value Invalid Exception is signaled when this is not true.

The Request Control Field is used to denote the type of REQIO to the machine. The following values are defined:

- Character 'N'- REQIO is a Normal Request.
- Hex '10'- REQIO is an Asynchronous Resource Manager request (Activate Resource).
- Hex '20'- REQIO is an Synchronous Resource Manager request (Deactivate Resource, Return Activate Resource Return RECFMS 00 Alerts).

Source/Sink Request (SSR) Template

• Template Size Specification	Char(8)
- Size of Template	Bin(4)
- Number of Bytes Available for Materialization	Bin(4)
• Request I/O Timeout (sync REQIO's only)	Char(8)
• Source/Sink Object (CD or LU0)	S-Ptr
• Response Queue	S-Ptr
• Source/Sink Data Area	S-Ptr
• Optional Pointer Area	Char(16)
• Reserved	Char(8)
• REQIO Time Stamp	Char(8)
• Request I/O Timestamp	Char(8)
• Request Priority	Bin(2)
• Request ID	Bin(2)
• Function Field	Char(1)
• Request Control Field	Char(1)
• Key Length	Bin(2)
• Offset to Key Field	Bin(2)
• Request Descriptor Count	Bin(2)
• Offset to Request Descriptor	Bin(2)
• Offset to REQIO Variable Parameters	Bin(2)
• Key Field (Variable- 10 - 256 bytes)	Char(*)
• Request Descriptor (2 byte aligned)	Char(16)
• Request I/O Variable Parameters	Char(*)
- Length of area	Bin(4)

- Reserved Char(28)
- Variable parameters Char(*)

MSCP ASYNCHRONOUS REQUEST DESCRIPTOR (RD)

For the following REQIO's, only 1 RD is allowed: Activate Resource, Deactivate Resource, Return Activate Resource. For the RECFMS 00 Alert Operation REQIO, a transmit RD is required. For a response to the RECFMS 00 Alert, a receive RD with '00'X subcommand is required.

The Request/Response Header is ignored for the RECFMS 00 Alert Operations Reqio and the Return RECFMS 00 Alerts Reqio.

0	1	2	3-5	6-7	8-10	11	12-15
---	---	---	-----	-----	------	----	-------

Where:

- 0 = RU Flow Type
- 1 = Reserved
- 2 = Request Unit Subcommands
- 3-5 = Reserved
- 6-7 = RU Length
- 8-10 = Request Response Header
- 11 = Reserved
- 12-15 = RU Offset

Request/Response Unit Flow Type - Char(1):

- Bit 0 of the RU flow type indicates whether this is a transmit or receive RD
 - 0 - Transmit RD- Deactivate, Return Activate Resource Return RECFMS 00 Alerts, RECFMS 00 Alert Operations (to receive a response for a RECFMS 00 Alert Operation, a receive RD with '00'x subcommand is required) only.
 - 1 - Receive RD- Activate Resource RECFMS 00 Alert Operation, only.
- Bit 1 indicates whether the RD has been processed by the machine or is awaiting processing. The supervisory services management ensures that this bit is set to zero upon receipt of the REQIO. This bit may not be used by the user to cause the supervisory services management to skip the RD. The supervisory services management always assumes that all the RDs in the REQIO are to be processed. In a terminating or non-terminating error situation, the RD completion count will point to the RD on which the error was discovered. This RD will be marked processed. The values are:
 - 0 - not processed
 - 1 - processed

- Bits 2-3 are reserved and must be binary zero
- Bit 4 indicates I/O operation
 - 0 - Normal I/O operation
 - 1 - Immediate I/O operation
 This bit means transmit or receive immediate depending on the setting of bit 0.
- Bit 5 indicates Network Resource Activation operation (For Activate Resource REQIO's only. Otherwise reserved.)
 - 0 - Normal
 - Provides the Wait-On-Network-Resource-Activation function and will wait until the Network resource can be activated (LUD Contact Successful event signaled) prior to returning the REQIO.
 - 1 - Immediate
 - Provides the Immediate function and will not wait until the Network resource can be activated (LUD Contact Successful event signaled) prior to returning the REQIO.
- Bits 6-7 are reserved and must be binary zero

Reserved - Char(1):

Always set to binary zeros.

Request Unit Subcommands - Char(1):

- '00'x Default Operations: This subcommand is used to provide SSCP-LU flow compatibility with current releases of the communications REQIOs (e.g. LU-1 Logon/Logoff requests).
- '81'x Activate Resource: This subcommand is used to Activate the Resource (LUD) for use by the requesting MI user. When the activation of the Network is required, during normal operation or after recovery (MODCD instruction issued), the REQIO is held pending provided Wait-On-Network-Resource-Activation is indicated, until the connection is established or a MODIFY LUD Vary Off, MODIFY CD/LUD Cancel, REQIO Deactivate Resource/Return Activate Resource instruction is issued to force the REQIO to be returned.

However when the Network Resource Activation Operation specified is "Immediate" the Network is not Activated, any associated Intervention Required events are not signaled and the REQIO is returned with a FBR error Code of '0814'x.

During the processing of this Subcommand the MSCP may be required to activate the Network to contact the remote station represented by the CD. To accomplish this:

1. For a Switched Network the Manual Intervention event (0004,06,03) is signaled when the REQIO is the first received for any LUD attached to a VARIED ON PENDING CD with the Recovery Activation status area indicating CONTINUE.

2. For a MTAM Leased Network the Manual Intervention event (0004,06,04) is signaled when the REQIO is the first received for any LUD attached to a VARIED ON PENDING CD with the LUD CD Recovery Activation status area indicating NORMAL PENDING. The MI user must also issue a MODIFY CD (Continue) instruction for the Controller (CD) to direct the MSCP to establish contact with the appropriate remote Station and reinitiation of the Logical Unit.

The following modify LUD or CD commands do not cause the Activate Resource REQIOs to be flushed back to the MI users queue.

MODIFY CD Abandon Connection

MODIFY LUD Reset

MODIFY LUD Quiesce

MODIFY LUD Suspend

MODIFY LUD Deactivate

'91'x RECFMS 00 Alert Operations: This subcommand is used to provide SSCP-PU flow alert support when communicating with a DP host. Alert's are not supported for PU Type 2 <-> PU Type 2 connections (i.e. to another S/38 or other APPC peer devices). The SSR must contain a system pointer to a CD, a system pointer to an MI response queue, a space pointer to the data in an SSD, and a transmit RD. For a response to the RECFMS 00 Alert Operation to be passed above MI, a receive RD with a '00'X subcommand is required. There is no error checking of the RECFMS RU in the SSD.

The REQIO is passed from MSCP to the LUL/LU6.2 station IOM. The SIOM will verify that the SSCP-PU flow is established. The REQIO is

handled as any other xmit/receive REQIO and will be returned upon completion of the I/O operation. For a + or - response from the DP host, the SIOM will return a '0800'x FBR. CPF must check the SSD for any error data.

The RECFMS 00 Alert Operation requires FM Profile 0 and Transmission Services Profile 1. (Refer to SNA documentation for further description of FM and TS Profiles.) Note that FM Profile 0 requires that only 1 RECFMS 00 Alert can be outstanding at a time to the host.

Reserved - Char(3):

Always set to binary zeros.

Request/Response Unit Length - Bin (2):

For a transmit RD, this field contains the length of the output RU. A length of zero indicates there is no RU associated with this RD. For a receive RD, before it is processed, this field specifies the space available in the SSD for the RU. After the receive RD is processed, this field contains the length of the received RU. If a group of receive RDs is specified in the SSR, the space available for all of the RUs can be specified in the first RD of the group. The RU length field in the remaining RDs of the group is set to zero. When the RDs in the group are processed by the machine, the RU length and offset fields are updated to the length and offset of the received RUs. The SSR can have more than one group of receive RDs. The RUs for all RDs in the SSR must be located in the same SSD.

Request/Response Header - Char(3):

The Request/Response Header is ignored for the RECFMS 00 Alert Operations REQIO and the Return RECFMS 00 Alerts REQIO.

These three bytes contain the information for the request/response header (RH). For the send RD, the information is supplied to the machine in this field. For the receive RD, the information is inserted in this field when the RD is processed by the machine. All unused bits are identified as reserved and must be set to zero.

- Byte 0 of the Request Header:

- Bit 0 = 0 indicates this RU is an SNA request. In SNA, the terms request and response have precise definitions not to be confused with commands or replies.

- Bits 1-2 are used to identify which of the type of RU are being processed. The only valid combination of bits for the MSCP request is:
 - 11 - Session Control for Activate Resource, Deactivate Resource, or Return Activate Resource
- Bits 3-7 Reserved must be binary zero.
- Bytes 1-2 of Request Header must be binary zero.
- Byte 0 of the Response Header:
 - Bit 0 = 1 indicates this RU is an SNA response.
 - Bits 1-2 same as the corresponding request header bits.
 - Bits 3-7 Reserved must be binary zero.
- Byte 1 of Response Header:
 - Bits 0-3 Reserved must be binary zero.
 - Bit 2 the same as the corresponding Request Header bit.
 - Bit 3 response indicator
 - 0 - positive response.
 - 1 - negative response.
 - Bits 4-6 Reserved must be binary zero.
- Byte 2 of Response Header must be binary zero.

Reserved - Char (1):

Always set to binary zeros.

Request/Response Unit Offset - Bin(4):

The four byte RU offset is a displacement, in bytes, to the beginning of an RU from the beginning of the SSD space. An RU associated with a specific RD can be located by displacing into the SSD space an amount equivalent to the RU offset. The RU offset for a receive RD is updated by the machine if the RU length in the RD is specified as zero (ie, the RD is designated as a part of an RD group).

MSCP SYNCHRONOUS SOURCE/SINK REQUEST (SSR)

The synchronous REQIO has the same SSR template and field definitions as the asynchronous REQIO. The only exceptions to the asynchronous definitions and operations are as follows:

- The Request Control field will indicate a Synchronous REQIO via an '20'X being encoded.
- The requested I/O operation is processed synchronously by the machine with the process issuing the REQIO being suspended until the operation is complete. The completion of this operation is indicated by the process being resumed at the next instruction following the REQIO. Put another way--- The completion of the REQIO is not indicated by the posting of a feedback record to the request I/O response queue specified in the SSR or the signaling of the request I/O completed event if signaling is specified in the SSR.
- The following verifications are performed on the objects referenced by the SSR pointers and on the SSR data before execution of the I/O operation is started. If the verification is not successful, an appropriate exception is signaled and the instruction terminated:
 - A 3403 Object State Invalid Exception- The object (CO or LU0) specified in the SSR is in the Varied Off state.
 - A 3401; 3402 S/S Configuration Invalid Exception- The object type specified in the SSR does not support the Synchronous Resource Manager REQIO.
 - A 3801 Template Value Invalid Exception- The Subcommand specified in the RD is not a valid Synchronous Resource Manager request.
- Timeout Value: Each synchronous REQIO SSR contains a Timeout Value which is used to specify the desired length of time which the machine should allow for that operation to complete. If the operation does not complete within the specified time, the operation is terminated and the Partial System Object damage set exception will be signaled. If no Timeout Value is specified within the SSR template, a model dependent default time will be used. Any non zero timeout value supplied must fall within limits defined in model dependent documentation. Timeout will not occur in less than this value.

MSCP SYNCHRONOUS REQUEST DESCRIPTOR (RD)

The synchronous RD has the same format and field definitions as the asynchronous RD.

- Request Unit Subcommands:
 - '83'X Deactivate Resource: This subcommand is used to flush back to the user's return queue the pending Activate Resource REQIO, associated with the LUD specified in the SSR, with FBR status indicating the condition.

- '84'x Return Activate Resources: This subcommand is used to flush back to the user's return queue all pending Activate Resource REQIOs, associated with the LUD specified in the SSR, with FBR status indicating the condition. When a CD pointer is specified the Activate Resource REQIOs are flushed for all attached LUDs.
- '92'x Return RECFMS 00 Alert REQIOs: This subcommand is used to flush back to the user's return queue all RECFMS 00 Alert REQIOs associated with the CD specified in the SSR. The SSR must contain a system pointer to a CD, a system pointer to an MI response queue, and a transmit RD.

The REQIO is passed from MSCP to the LUI/LU6.2 station IOM. The SIOM will return all RECFMS 00 Alert REQIOs with a '480A'x or '4809'x FBR.

MSCP FEEDBACK RECORD (FBR)

The MSCP follows the standard procedure for signaling the completion of a request. That is, a FBR is generated and sent to the MI response queue specified in the SSR for each REQIO. The two byte error summary field in the FBR contains the appropriate information about completion status for the entire REQIO. The MSCP FBR may include session dependent error status in the optional field provided for this purpose.

Error Summary	Dev Dep Error	Hardware Error	Probable Cause or Meaning	Recommended Recovery Action
0800			Normal completion	REQIO completed normally; continue normal processing
0814			The "Immediate" Network Resource Activation Operation was specified and the resource is not activated.	The activation of the resource required a connection be established. 1. Change the Network Resource Activation Operation to Normal "Wait On Resource". 2. Reissue the REQIO
0844			Source/Sink data area too small	Correct the data length field in the RU.
4809			REQIO not processed due to MODLUD (Reset), an error on MODLUD (Quiesce), or return RECFMS 00 Alerts REQIO.	Continue performing the cleanup process.
480A			REQIO not complete due to MODLUD (Reset) an error on MODLUD (Quiesce) or Return RECFMS 00 Alert REQIO.	Continue performing the cleanup process.
4830			Invalid Object type	The object specified in the SSR does not support an MSCP-LU flow.
4831			REQIO not complete due to the object being in an invalid state of Varied Off.	Allocation of the Resource cannot be accomplished while in these states. 1. Issue the MODLUD/MODCD Vary On command. 2. Reissue the REQIO
4834			REQIO not complete due to the MODCD/ND (Cancel), MODLUD (Cancel/Vary Off) instruction.	Continue performing the cleanup process.
4835			REQIO not complete due to the Deactivate Resource REQIO.	Continue performing the cleanup process.
4836			REQIO not complete due to the Return Activate Resource REQIO.	Continue performing the cleanup process.
4854			REQIO not complete due to the SSCP/PU session not active.	Reissue the REQIO after the session has been established.
4884			REQIO has an Invalid SSD pointer SSD pointer cannot be zero if the data length is not zero.	1. Correct either the SSD pointer or the data length field. 2. Reissue the REQIO.
4887			Invalid Command: 1. RD contains invalid CMD bit combination. 2. Reserved field violation	User program error.

5.3.3.7 Supervisory Service Events

Several events are defined which require definite action to be taken by an MI process in order to

continue normal processing. The handling of these events and servicing of the requests is discussed in each communications management section.

5.3.3.8 Exception Codes Signaled for Communications Recovery

MODIFY CD S/S RESOURCE NOT AVAILABLE EXCEPTION

For communications CDs the S/S Resource Not Available Exception ('3404'X) can occur on MODIFY CD instructions which attempt the following state changes:

COMMAND	GENERIC	SPECIFIC CODE
VARY ON	'2202'x	Local Workstation: Error Code--Vary On failures. For this case, the corresponding failure event will not have been signaled. Switched/Leased Lines: None--Exception cannot be signaled for this case
DIAL OUT	'2204'x	'0401'x--Dial out failure due to all ND candidates in the CD being in use or Inoperative Pending/Cancel is indicated in the ND Recovery Activation status area. '0402'x--Inoperative Pending or Cancel status set in the CD Recovery Activation status area. For this case, the corresponding failure event will have been signaled.
CONTINUE	'2208'x	Switched Lines: None--Exception cannot be signaled for this case Leased Lines: The ND status will be copied into the CD and attached LUD's '0801'x--Inoperative Pending status set in the ND object. For this case, the corresponding failure event will have been signaled. '0802'x--Cancel Status set in ND object. Local Workstation: Error Code--Vary On failures. For this case, the corresponding failure event will have been signaled.
CANCEL	'2209'x	None--Exception cannot be signaled for this case.

MODIFY LUD S/S RESOURCE NOT AVAILABLE EXCEPTION

For communications LUDs the S/S Resource Not Available Exception ('3404'X) can occur on MODIFY LUD instructions which attempt the following state changes:

COMMAND	GENERIC	SPECIFIC CODE
VARY ON	'2302'x	None--Exception cannot be signaled for this case.
ACTIVATE	'2303'x	BISYNC/MTAM Error Code--Recovery is not complete and the LUD can not be placed in the Active Session state until the LUD Contact Successful (000B,06,01) event has been signaled. For this case, the corresponding failure event will have been signaled. 'D016'x - Disconnect received. CD failure event signaled. 'E021'x - Line failure. ND failure event signaled. 'E022'x - Station failure. CD failure event signaled. 'E023'x - MTAM only - attempted to use invalid combination of printer and punch LUD's. Workstation/LU-1 None--Exception cannot be signaled for this case.
CONTINUE	'2308'x	The CD status will be copied into the LUD. '1401'x--Inoperative Pending status set in the CD object. For this case, the corresponding failure event will have been signaled. '1402'x--Cancel Status set in CD object. '1403'x--Device failure
CANCEL	'2309'x	None--Exception cannot be signaled for this case.
SUSPEND	'231x'x	'1201'x Suspend Timeout
QUIESCE	'2313'x	'1301'x Quiesce Timeout '1302'x Quiesce rejected due to terminating error
RESUME	'2311'x	MTAM only 'E021'x 'E022'x (same as above) 'D016's

MODIFY ND S/S RESOURCE NOT AVAILABLE EXCEPTION

For communications NDs, the S/S Resource Not Available Exception ('3404'X) can occur on MODIFY ND instructions which attempt the following status changes:

COMMAND	GENERIC	SPECIFIC CODE
VARY ON	'2102'x	Error Code--Activate Link failures. For this case, the corresponding failure event will not have been signaled.
MANUAL ANSWER	'2103'x	Error Code--Initial Line failures. For this case, the corresponding failure event will have been signaled. '0301'x--Inoperative Pending or Cancel status set in the ND Recovery Activation status area. For this case, the corresponding failure event will have been signaled.
MANUAL START DATA	'2104'x	None--exception cannot be signaled for this case.
ENABLE SWITCHED LINE	'2105'x	None--Exception cannot be signaled for this case.
CONTINUE	'2108'x	Error Code--Initialize Line Failures. For this case, the corresponding failure event will have been signaled.
CANCEL	'2109'x	None--exception cannot be signaled for this case.

For each of these cases, the error code will be the same code as is supplied on the corresponding ND failure event. Since the exception error codes for the MODIFY ND instruction will be a subset of those supplied as event data for the ND failure event, the recovery action should be based on the failure event rather than on these exceptions.



5.3.4 INTERCONNECTED SYSTEMS (APPC) COMMUNICATIONS RECOVERY

During the life of a connection errors may occur due to a failure of the device or the path that connects them (Link/Station failures). For these type errors notification is given to the MI user via several events which require definite action in order to continue normal processing (establish the connection and contact the remote device). In addition to the events, error notification will also be given to the MI user via an error FBR response indicating the type of error. After the failure the machine will queue Activate Resource REQIO requests until the failure is corrected by PROGRAMMED retry or OPERATOR intervention. Whenever a REQIO(CONTINUE) instruction is issued the MI user may continue to execute and issue REQIOs until an access of the link is required or a FBR error code of '0018'X (no data) is received. However if an access of the link (transmit) is requested the REQIO would be returned with a FBR error code indicating the type of failure.

- Vary On Processing: These errors occur when a request to establish a connection or completion of the Vary On/Continue processing has failed for a leased line. The recovery procedures initiated by the MSCP will cause the state/status transitions as described in section 5.3.4. for all associated objects. However, for all switched line connection failures the machine will perform the necessary recovery for the ND and CD objects, where applicable, provided these failures were not a result of an inoperative line or station.
- Device Failures: These errors occur when a -RSP to Bind has been received (Local Contention-Winner sessions only) or the -RSP Bind has been sent for all MODENAMES for this LU and all Activate Resource REQIOs have been returned with a FBR error code indicating the "Failed" condition. Recovery for these errors are limited in scope and may involve changes to the LUD Device Specific Area (DSA) at the System/38 or remote LU. These changes are accomplished only via a Vary Off of the associated object
- Disconnect Normal/Abnormal: This condition occurs when a "DISC or RD" is received from the remote station. For these conditions the recovery procedures initiated by the MSCP will cause the state/status transitions as described in section 5.3.4. for all associated objects. The Active LUDs do not attain the state of the CD with which they are associated but remain in the state attained prior to the failure to allow the error notification to be sent for all active LUDs.
- Inoperative: When notification is received from the IOM that an unrecoverable error has occurred the recovery procedures

initiated by the MSCP will cause the state/status transition as described in section 5.3.4. for all associated objects. The Active LUDs do not attain the state of the CD with which they are associated but remain in the state attained prior to the failure to allow the error notification to be sent for all active LUDs.

- Function Checks Assignable to the MI User Data: These type of errors, SSD and Queue destroyed, are recoverable by the IOM and the associated LUD is not placed in an ERP state. It must be recognized that these errors may cause the OU tasks to fail and will require Recovery to the extent that they be placed in an operational state where the transmission and receipt of data from the Link will occur when the Recovery is complete.
- Partial System Object Damage: These errors are not recoverable by the MSCP due to the inability to discover where the error occurred or how, under MSCP control, to bypass or correct the error to the point where the IOM/OU Tasks are capable of performing a useful function. Recovery for these errors are limited in scope, due to the nature of the failure, and is accomplished thru the following procedures:
 - The necessary VLOG Dumps of the IOM and OU tasks are taken and the tasks destroyed.
 - Will cause the State/Status transition as described in section 5.3.4. for the associated object(s).
 - For recovery the MI user must Vary Off the associated object(s).

5.3.4.1 Interconnected Systems Recovery/Restart Procedures

Inoperative Pending (Link/Station): The MI user must provide the capability to activate the link, MODIFY ND (Continue), represented by the ND that incurred the error. The MI user must also issue a MODIFY CD (Continue) instruction for each Controller (CD) to direct the MSCP to establish contact with the appropriate remote Station and reinitiation of the Logical Unit. The connection is established when for a switched network an incoming call is received, an explicit request (MODIFY CD Dial) to dial out is made or the remote Station is Contacted on a leased line. The MSCP will validate the request and complete the processing as described in Section 5.3.4. for the "Modify CD (Continue)" MI Instruction support.

Normal Pending (Primary Leased Network): The MI user must provide the capability to activate the station, MODIFY CD (Continue), represented by the CD that incurred the Disconnect, to direct the MSCP to establish contact with the appropriate remote

Station and reinitiation of the Logical Unit. To accomplish this the Primary Intervention event (0004,06,04) is signaled when a Activate Resource REQIO is the first received for any LUD attached to a VARIED ON PENDING CD with the Recovery Activation status area indicating NORMAL PENDING. The MSCP will validate the request and complete the processing as described in Section 5.3.4. for the "Modify CD (Continue)" MI Instruction support.

For recovery failures, the MI user is not able to correct the error, a supervisory request for the ND, MODIFY ND (Cancel), for each Controller, MODIFY CD (Cancel) or for each device, MODIFY LUD (Cancel), must be issued in order to propagate the error to any pending Activate Resource REQIOs and suspend any reactivation attempts.

5.3.4.2 Interconnected Systems Communications Recovery MI Interface

This section describes the programming considerations and specific support requirements for communications recovery. Communications with the remote Device after error notification is accomplished through the following MI command support.

- MODND Recovery/Activation Status:
 - Cancel
 - Continue
- MODCD Recovery/Activation Status:
 - Cancel
 - Continue
- MODLUD Recovery/Activation Status:
 - Cancel
 - Continue

Each of the modifiable elements within the Recovery/Activation status area can only be successfully modified subject to the status indicated within the object. If the status is such that modification of the requested element cannot be allowed, a S/S Object State invalid exception is signaled. Refer to the figures described in section 5.3.3 for each object for a description of the status which exists and the valid changes which can be made using the MODIFY Continue/Cancel options.

Any modification options that involve a change to the objects while using the Recovery Activation status element modification option, will result in an Template Value Invalid exception being signaled and the modification of the object is stopped at that point.

When a CD (Leased Network only) or LUD is being explicitly Varied On using the Modify CD/LUD instruction and the resource is not available due to failures (status indicates Inoperative Pending, Cancel or Normal Pending) being set prior to the Vary On, the object status for the CD is set to the status of the ND and for the LUD the status is set to the status of the CD.

Modifications of the S/S objects for operations involving the Recovery/Activation status area are not ensured by object locks and maybe changed independently by another process even though they are locked "exclusive".

5.3.4.2.1 MODIFY NETWORK DESCRIPTION (MODND)

MODND (CANCEL)

This command is used to suspend the reconnection and reuse of the communications line and is accomplished thru the Recovery/Activation indicators contained within the objects. The Cancel status is set in the ND and for a leased network all attached CD(s) and their associated LUD(s) provided they are not in the VARIED OFF state.

MODND (CONTINUE)

This command is used to enable (allow) the reuse of the line after an unrecoverable error has occurred and is accomplished thru the Recovery/Activation indicators contained within the ND object. The "Continue" status is set for the ND object only regardless of the network connect method.

During the CONTINUE processing as part of MODIFY ND, the MSCP is requested to activate the link represented by this ND. Activation of the link includes all the logical and physical initialization required before a remote Station on that link can be contacted. When the ND is for a Leased line the line is prepared for transmitting to the attached Station. When the ND being activated represents a connection into the switched network, that communications adapter is initialized and prepared for calls. Its usage is governed by the option specified in the Switched Connect Method Field. If "Dialin" is specified, the link is activated for incoming calls. If "Dialout" is specified, the link is activated for outgoing calls. If "Either dialin or dialout" is specified, the link is activated for incoming calls. Should it be necessary to use this facility for a dial out call before a dial in has occurred, the resource is available and can be so allocated.

5.3.4.2.2 MODIFY CONTROLLER DESCRIPTION (MODCD)

MODCD (CANCEL)

This command is used to suspend the reconnection and reuse of the CD and is accomplished thru the Recovery/Activation indicators contained within the CD and LUD objects. The "Cancel" status is set in the CD and attached LUD(s) provided they are not in the VARIED OFF state. In addition any pending Activate Resource REQIOs are returned with a FBR error code indicating the "Canceled" condition.

MODCD (CONTINUE)

This command is used to enable (allow) the reuse of the Controller and request the MSCP to establish contact again after an unrecoverable error has occurred. This is accomplished thru the Recovery/Activation indicators contained within the

CD and LUD objects. The "Continue" status is set for the CD and all associated LUD(s) provided the attached LUD(s) are not in the VARIED OFF state. However, when Activate Resource REQIOs are present (queued) the Activation Pending status is set for the associated LUD(s). The following sequence describes the processing of the MODIFY CD (Continue) instruction:

- When the CD represents a remote Station using the switched network facilities and an Activate Resource REQIO is present for any attached LUD, the Switched Intervention event (0004,06,03) is signaled. However, when an Activate Resource REQIO is not present (queued) for any of the LUD(s) associated with this Controller the CD remains in the VARIED ON PENDING state, the event is not signaled, and physical contact will not be made until an incoming call is received.
- When the remote Station is contacted the CD is brought to the VARIED ON state and the CD Contact event (Successful) is signaled.
- The CD object is set to the ACTIVE LUD(s) VARIED ON state whenever the first LUD attached to this controller completes the Vary On processing being performed by the MSCP.
- The CD object is set to the ACTIVE LUD(s) ACTIVE state whenever the first LUD attached to this controller completes the asynchronous LUD Vary On processing being performed by the MSCP and the LUD state indicates the RESET, QUIESCE, SUSPEND, or ACTIVE SESSION state or a Modify LUD Activate Session is issued.
- The CD status is set to Active when the first session is bound for any LUD attached to the CD.

The network resources are allocated and the connection established as a result of an incoming call being received, an explicit request (MODIFY CD-DIAL) to dial out is initiated by an MI process or the remote Station is varied on line. Upon completion of the connection, the MSCP receives the Exchange ID (XID) information as sent by the remote Station. The MSCP validates the identity of the far end Station and completes the processing based on the following checks:

- The Exchange ID matches the Exchange ID field in a Controller Description.
- The CD object indicates the VARIED ON PENDING state.
- The ND representing the line on which the call is made is included in the ND candidate list of this CD.

To put it another way: the remote PU must be known to the system, must not be VARIED OFF and must be allowed to use this line. If any of these checks

fail, the connection is broken and the appropriate MI event is signaled.

5.3.4.2.3 MODIFY LOGICAL UNIT DESCRIPTION (MODLUD)

MODLUD (CANCEL)

This command is used to suspend the device and sets the "Cancel" status in the Recovery/Activation area contained in the LUD and any pending Activate Resource REQIOs are returned with a FBR error indicating the "Canceled" condition.

MODLUD (CONTINUE)

This command is used to enable (allow) the reuse of the device after an unrecoverable error has occurred and sets the "Continue" status in the Recovery/Activation area contained in the LUD. However, when Activate Resource REQIOs are present (queued) the Activation Pending status is set for the associated LUD.

A LUD representing a Logical Unit associated with a remote Station on a leased line, or a remote Station using the switched network facilities, do not attain the state of the CD with which they are associated but remain in the state attained prior to the failure.

The MSCP will complete the Pending Continue function as described below.

- The Logical Unit Description event Class X'000B', Type 6, Subtype 1, (LUD Contact Successful) is signaled, when the connection is established and the asynchronous Vary On LUD processing being performed by the MSCP completes successfully.
- When the LU-LU path is activated, +RSP to Bind is received or sent, the LUD and associated CD status is changed to Active.

5.3.4.3 Interconnected Systems Services Machine Services Control Point (MSCP)

The MSCP is the VMC component that coordinates supervisory service requests for all users of the Interconnected Systems Services. Requests for services maybe processed directly by the MSCP or maybe redirected to other supervisory components that will provide the requested function. Supervisory service requests include:

- Internal machine functions associated with VARYing ON and VARYing OFF of a line, PU or LU.
- Switched connection support such as initiating and completing calls.
- Requests initiated at a remote LU (ie, SNA Session, and Conversation allocation).

- Error recovery procedures.

There are certain resource requests ATTACH (Program Start) received by the MSCP that cannot be serviced within the machine. To assure that these requests are properly serviced, there must always be a process with the responsibility for handling these requests. Dependent on the conditions that exist the system protocol may require further communication with the MSCP or with the LU that initiated the request.

Many of the functions provided by the MSCP are implicitly requested when a SS MODIFY instruction is executed to VARY ON or VARY OFF a component. Some of these functions are not apparent at MI, particularly the activation of the LU Sessions. However, for Interconnected Systems Services the availability, allocation, and use of these resources must be understood by the MI user.

5.3.4.3.1 MODIFY/MATERIALIZE NETWORK DESCRIPTION (MODND)

During the VARY ON processing as part of MODIFY ND, the MSCP is requested to activate the link represented by this ND. Activation of the link

includes all the logical and physical initialization required before a remote PU on that link can be contacted. When the ND is for a Leased line the line is prepared for transmitting to the attached PU. When the ND being activated (VARIED ON) represents a connection into the switched network, that communications adapter is initialized but will not be prepared for calls until it has been placed in the Switched Enabled State by a MODIFY ND (enable). Once placed in this state, its usage is governed by the option specified in the Switched Connect Method Field. If "Dialin" is specified, the link is activated for incoming calls. If "Dialout" is specified, the link is activated for outgoing calls. If "Either dialin or dialout" is specified, the link is activated for incoming calls. Should it be necessary to use this facility for a dial out call before a dial in has occurred, the resource is available and can be so allocated. Allocation and use of switched line facilities is controlled via the MODIFY instructions to VARY ON and OFF LUDs, CD's and ND's and by maintaining an ND candidate list in the CD for each remote PU capable of using the switched network.

ND Modify/Materialize Template

	Element Length	Sub Element Length	Modify Option Value	Materialize Option Value
• State/Status Definition	Char(16)		4001	Z001
- State Change/Status		Char(6)		
Bytes 0-1 --- - MAT - ND Active Count MOD - Reserved		Bin(2)		
Byte 2 --- Bit 0 - MAT - Network Active MOD - Reserved		Bit(1)		
Bit 1 - MAT - Manual Dial Start State MOD - Abandon Call		Bit(1)		
Bit 2 - MAT - Manual Answer Start State MOD - Manual Start Data Command		Bit(1)		
Bit 3 - MAT - Manual Answer State MOD - Manual Answer Command		Bit(1)		
Bit 4 - MAT - Dial Pending State MOD - Disable Command		Bit(1)		
Bit 5 - MAT - Switched Enable State MOD - Enable Command		Bit(1)		
Bit 6 - MAT - Varied On State MOD - Vary On Command		Bit(1)		
Bit 7 - MAT - Varied Off State MOD - Vary Off Command		Bit(1)		
Byte 3 Bit 0 - MAT - Diagnostic Mode MOD - Set Diagnostic Mode		Bit(1)		
Bit 1 - MAT - Diagnostic Active Indicator MOD - Reset Diagnostic Mode		Bit(1)		
Bits 2-7 - Reserved		Bit(6)		
Bytes 4-5 --- Reserved		Char(2)		
- Recovery/Resource Activation Definition		Char(2)		
Byte 0 --- Bit 0 - MAT - Inoperative Pending MOD - Reserved		Bit(1)		
Bit 1 - Reserved		Bit(1)		
Bit 2 - MAT - Normal Cancel MOD - Cancel		Bit(1)		
Bit 3 - MAT - Normal Continue MOD - Continue		Bit(1)		
Bits 4-6 - Reserved		Bit(2)		
Bit 7 - MAT - Normal Active MOD - Reserved		Bit(1)		
Byte 1 - Reserved		Char(1)		
- Reserved		Char(8)		

ND STATE CHANGE RULES

Modify Instruction	Allowable States for Modification								
	Diagnostic Mode	Varied Off	Varied On	Switched Enabled	Dial Pending	Manual Answer	Manual Answer Start Data	Manual Dial Start Data	Network Active
Vary On	NO	YES	NO	NO	NO	NO	NO	NO	NO
Enable	NO	NO	YES	NO	NO	NO	NO	NO	NO
CD Dial	NO	NO	NO	YES	NO	NO	NO	NO	NO
Manual Answer	NO	NO	NO	YES	NO	NO	NO	NO	NO
Manual Start Data	NO	NO	NO	NO	YES	YES	NO	NO	NO
Abandon Call	NO	NO	NO	NO	NO	YES	YES	NO	NO
Disable	NO	NO	NO	YES	NO	NO	NO	NO	NO
CD Abandon Connection	NO	NO	NO	NO	YES	NO	NO	YES	YES
Vary Off	NO	NO	YES	NO	NO	NO	NO	NO	NO
Cancel	NO	NO	YES-(1)	YES	NO	NO	NO	NO	YES-(1)
Continue	NO	NO	YES-(1)	YES	NO	NO	NO	NO	YES-(1)

- -(1) Modification for a Leased Line only; Otherwise "NO".

ND OBJECT RECOVERY/ACTIVATION STATUS TRANSITIONS

[illegible]

- <—> Status transition caused by successful completion of S/S Modify instruction.
- ---> Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,01 CD Contact Successful.
- <--- Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful "For a Switched Line".
 - 0004,04,03 CD Loss of Contact.
 - 0004,05,01 CD Failure "For a Switched Line".
- <+++ Status transition asynchronous to the S/S instruction caused by a failure. Notification of this status change is given via the following events:
 - 000E,05,01 ND Line Failure.
 - 0017,08,01 Partial System Object Damage set.
- NOTE: Any events not specified will not result in a Status transition.

ND STATUS CHANGE RULES

Modify Instruction	Allowable Status for Modification			
	Inop Pending	Cancel	Continue	Active
Vary on	NO	NO	YES	NO
Enable	YES	YES	YES	NO
CD Dial	NO	NO	YES	NO
Manual Answer	NO	NO	YES	NO
Manual Start Data	NO	NO	YES	NO
Abandon Call	NO	NO	YES	NO
Disable	YES	YES	YES	NO
CD Abandon Connection	NO	NO	YES	NO
Vary Off	YES	YES	YES	NO
Cancel	YES	NO	NO	NO
Continue	YES	YES	NO	NO

5.3.4.3.2 MODIFY/MATERIALIZE CONTROLLER DESCRIPTION (MODCD)

A request is initiated during processing of MODIFY CD - VARY ON directing the MSCP to establish contact with the appropriate remote PU.

While the MSCP is always requested to contact a remote PU during VARY ON CD processing, physical contact with the remote PU cannot always be made at this time. The remote PU cannot be contacted if a switched connection is required and has not been completed or if the remote PU is not varied on line for a leased connection.

The following sequence describes the state of the CD object resulting from the processing of the MODIFY CD (Vary On) instruction:

- The CD object is set to a VARY ON PENDING state and the MODIFY CD instruction is completed. The remaining activity is performed asynchronously by the MSCP.
- When the remote PU is contacted the CD is brought to the VARIED ON state and the CD Contact Successful event (0004,04,01) is signaled.
- The CD object is set to ACTIVE; LUDs VARIED ON state whenever the first LUD attached to this controller completes the Vary On processing being performed by the MSCP.
- The CD object is set to ACTIVE SESSION state whenever the first LUD attached to this controller completes the asynchronous

LUD Vary On processing being performed by the MSCP and the LUD state indicates the RESET, QUIESCE, SUSPEND, or ACTIVE SESSION state or a Modify LUD Activate Session is issued.

- The CD status is set to Active when the first session is bound for any LUD attached to the CD.

The network resources are allocated and the connection established as a result of an incoming call being received, an explicit request (MODIFY CD-DIAL) to dial out is initiated by an MI process or the remote PU is varied on line. Upon completion of the connection, the MSCP receives the Exchange ID (XID) information as sent by the remote PU. The MSCP validates the identity of the far end PU and completes the processing based on the following checks:

- The Exchange ID matches the Exchange ID field in the controller description.
- The CD object indicates the VARIED ON state.
- The ND representing the line on which the call is made is included in the ND candidate list of this CD.

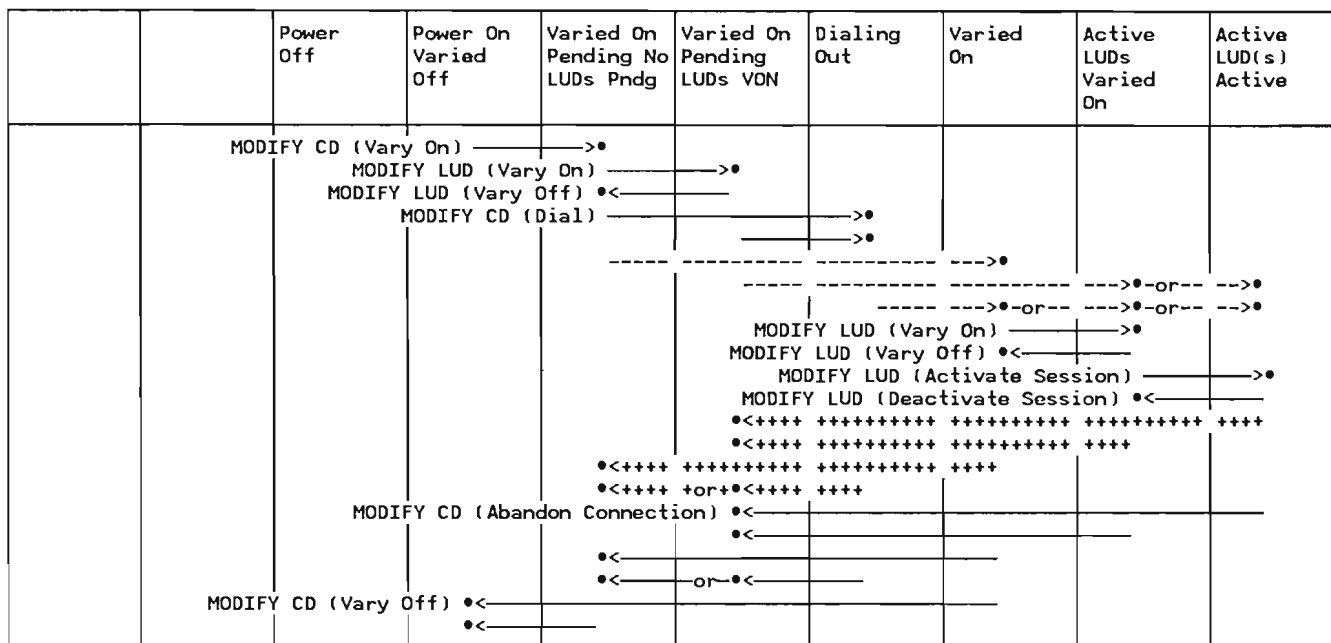
To put it another way: the remote PU must be known to the system, must not be VARIED OFF, and must be allowed to use this line. If any of these checks fail, the connection is broken and the appropriate MI event is signaled.

CD Modify/Materialize Template

	Element Length	Sub Element Length	Modify Option Value	Materialize Option Value
• State/Status Definition	Char(16)		4001	Z001
- State Change/Status		Char(6)		
Bytes 0-1 --- - MAT - CD Session Count MOD - Reserved		Bin(2)		
Bytes 2-3 --- - MAT - CD Active Count MOD - Reserved		Bin(2)		
Byte 4 --- Bit 0 - MAT - LUDs in Session MOD - Reserved		Bit(1)		
Bit 1 - MAT - LUDs Varied On MOD - Reserved		Bit(1)		
Bit 2 - MAT - Varied on State MOD - Dial Command		Bit(1)		
Bit 3 - MAT - Dialing Out State MOD - Abandon Connection		Bit(1)		
Bit 4 - MAT - Vary On Pending, LUDs Pending MOD - Reserved		Bit(1)		
Bit 5 - MAT - Vary On Pending State MOD - Vary On Command		Bit(1)		
Bit 6 - MAT - Reserved MOD - Vary Off Command		Bit(1)		
Bit 7 - MAT - Power On/Vary off State MOD - Power On Command		Bit(1)		
Byte 5 Bit 0 - MAT - Power Off State MOD - Power Off Command		Bit(1)		
Bits 1-3 - Reserved		Bit(3)		
Bit 4 - MAT - Diagnostic Mode MOD - Set Diagnostic Mode		Bit(1)		
Bit 5 - MAT - Diagnostic Active Indicator MOD - Reset Diagnostic Mode		Bit(1)		
Bits 6-7 - Reserved		Bit(2)		
- Recovery/Resource Activation Definition		Char(2)		
Byte 0 --- Bit 0 - MAT - Inoperative Pending MOD - Reserved		Bit(1)		
Bit 1 - MAT - Normal Pending MOD - Reserved		Bit(1)		
Bit 2 - MAT - Normal Cancel MOD - Cancel		Bit(1)		
Bit 3 - MAT - Normal Continue MOD - Continue		Bit(1)		

Bit 4 - MAT - Normal Activation Pending	Bit(1)
MOD - Reserved	
Bits 5-6 - Reserved	Bit(1)
Bit 7 - MAT - Normal Active	Bit(1)
MOD - Reserved	
Byte 1 - Reserved	Char(1)
	Char(8)

CD OBJECT STATE TRANSITIONS



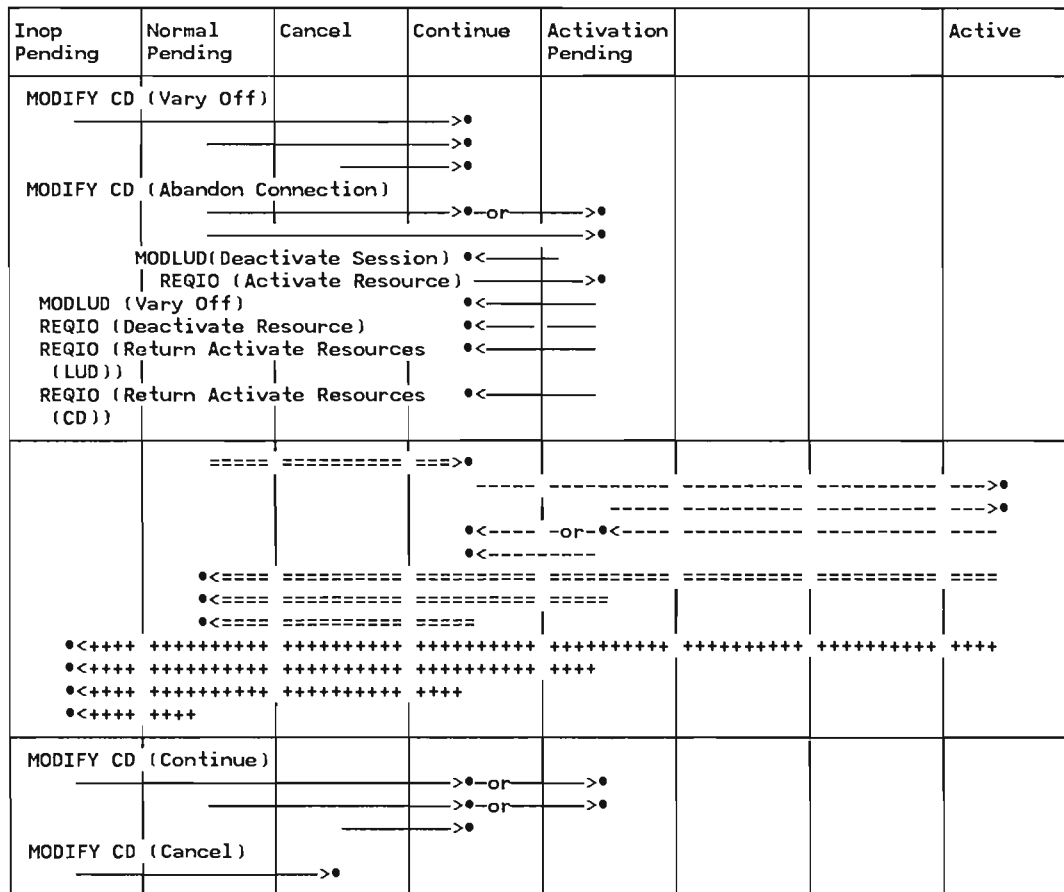
- <—> State transition caused by successful completion of S/S Modify instruction.
- ---> State transition asynchronous to the S/S instruction. Notification of this state change is given via the following events:
 - 0004,04,01 CD Contact Successful.
- <+++ State transition asynchronous to the S/S instruction caused by a failure. Notification of this state change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful
 - 0004,05,01 CD Failure.
 - 000E,05,01 ND Line Failure.
- NOTE: Any events not specified will not result in a State transition.

CD STATE CHANGE RULES

Modify Instruction	Allowable States for Modification								
	Diagnostic Mode	Power Off	Power On Varied Off	Varied On Pending No LUDs Pndg	Varied On Pending LUDs VON	Dialing Out	Varied On	Active LUDs VON	Active LUD(s) Active
Vary On	NO	NO	YES	NO	NO	NO	NO	NO	NO
LUD Vary On	NO	NO	NO	YES	YES	YES	YES	YES	YES
LUD Activate Session	NO	NO	NO	NO	YES	YES	NO	YES	YES
Dial	NO	NO	NO	YES	YES	NO	NO	NO	NO
Abandon Connection	NO	NO	NO	NO	NO	YES	YES	YES	YES
LUD Vary Off	NO	NO	NO	NO	YES	YES	NO	YES	YES
LUD Deactivate Session	NO	NO	NO	NO	YES	YES	NO	NO	YES
Vary Off	NO	NO	NO	YES	NO	NO	YES	NO	NO
Cancel	NO	NO	NO	YES	YES	NO	NO	NO	NO
Continue	NO	NO	NO	YES	YES	NO	YES-(1)	YES-(1)	YES-(1)

- -(1) Modification for a leased line (Primary only); Otherwise "NO".

CD OBJECT RECOVERY/ACTIVATION STATUS TRANSITIONS



- <--> Status transition caused by successful completion of S/S Modify or Synchronous REQIO instruction.
- ---> Status transition asynchronous to the S/S instruction when the first session is bound for any LUD attached to this CD.
- <--- Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,06,02 CD Unbound Intervention.
 - 000B,08,04 LUD Device Failure (Error Codes 0001 or 0002)
 - 000B,09,03 LUD NO Session Event
- <== Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,03 CD Loss of Contact.
- ==> Status transition asynchronous to the S/S instruction. Notification of this status change is given via the following events:
 - 0004,04,01 CD Contact Successful "For a Leased Line (Secondary only)".
- <+++ Status transition asynchronous to the S/S instruction caused by a failure. Notification of this status change is given via the following events:

- 0004,04,02 CD Contact Unsuccessful "For a Leased Line except for reason code 0005".
 - 0004,05,01 CD Failure.
 - 000E,05,01 ND Line Failure.
 - 0017,08,01 Partial System Object Damage set.
- NOTE: Any events not specified will not result in a Status transition.

CD STATUS CHANGE RULES

Modify Instruction	Allowable Status for Modification					
	Inop Pending	Normal Pending	Cancel	Continue	Activation Pending	Active
Vary On	NO	NO	NO	YES	NO	NO
LUD Vary On	YES	YES	YES	YES	YES	YES
LUD Activate Session	YES	YES	YES	YES	YES	YES
Dial	NO	NO	NO	YES	YES	NO
Abandon Connection	NO	YES	NO	YES	YES	NO
LUD Vary Off	YES	YES	YES	YES	YES	YES
LUD Deactivate Session	YES	YES	YES	YES	YES	YES
Vary Off	YES	YES	YES	YES	NO	NO
Cancel	YES	NO	NO	NO	NO	NO
Continue	YES	YES-(1)	YES	NO	YES-(3)	NO

- -(1) Modification for a leased line (Primary only); Otherwise "NO".
- -(2) Modification for a leased line (Primary only) and Normal Pending Status indicated along with Activation Pending Status; otherwise "NO".
- -(3) Modification for a leased line (MTAM only) and normal pending status indicated along with activation status; otherwise "NO".

5.3.4.3.3 MODIFY/MATERIALIZE LOGICAL UNIT DESCRIPTION (MODLUD)

A LUD associated with a remote LU on a leased line, or a remote LU using the switched network facilities, attains the same states as the CD with which it is associated.

The LUD object is set to a VARIED ON state when the MSCP completes the pending Vary On function. When the connection (CD Contact) is established, or if the connection already has been established, the LUD Contact Successful Event class '000B'X, type 6, subtype 1 is signaled. At this time the MODLUD (Activate) command may be issued, followed by Activate Resource, and then data transfer may be started.

During the LUD Activation processing, the MSCP initiates the required sequences to establish the SNA Session resource by which Conversations are allocated to engage in the exchange of information between two programs. The LUD object is set to ACTIVE SESSION state and the remaining activity is performed asynchronously by the MSCP.

Once the SNA session has been established, the remote LU can initiate unsolicited ATTACH (Program Start) requests initiated by a Transaction Program at the remote PU. Since the MSCP does not service these requests, it is necessary for the MI user to

acquire an MSCP-LU session Conversation ID for the Attach Manager that has the logic required to connect a Transaction Program for which the Attach requests has been received. This is accomplished by a Activate Resource REQIO (Attach Manager) to allocate the Conversation ID and will allow the MI process to issue REQIOs on the MSCP-LU flow to receive the Attach data and machine assigned Conversation ID. The MI process that receives the Attach has the responsibility to send the SNA response to the remote Transaction Process that originated the request. If any errors are detected by the MI User during the ATTACH processing, they should be reported to the remote LU, and then the MI User should issue a Deactivate Resource REQIO for the machine acquired Conversation ID. When the Attach Manager Conversation is not activated the Machine will send an FMH-7 X'084B6031' to the remote Transaction Process that originated the request and raise the LUD Unsolicited Message Event (000B,05,22); when the Attach Manager Conversation is activated the Machine will hold the request enqueued until a REQIO is received on the Attach Manager Conversation (no event will be raised). The data returned by the Machine to the REQIO's SSD space is specified in Section 5.4.3.

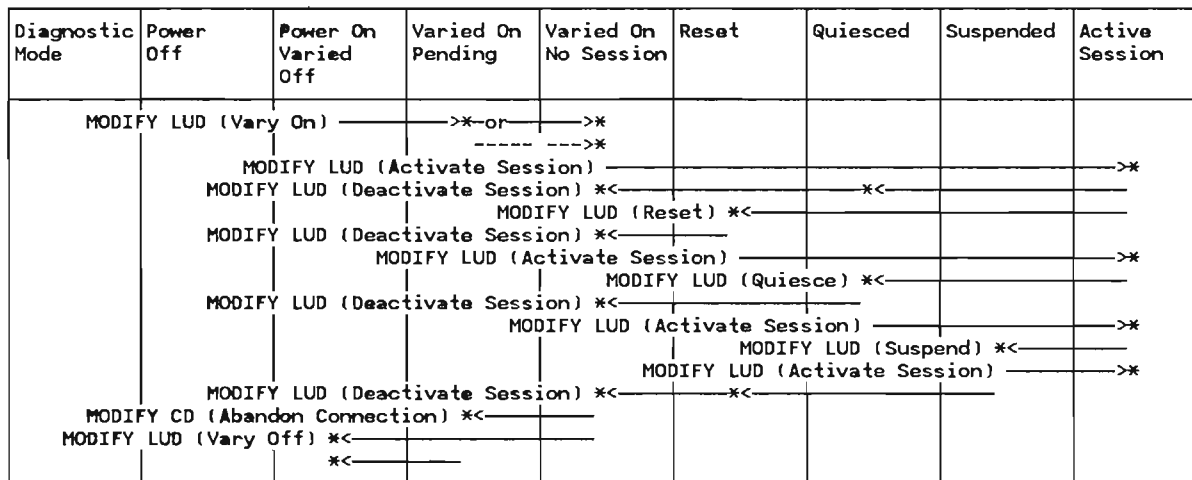
MODIFIES THAT CHANGE THE LUD PARAMETERS WILL ONLY TAKE EFFECT WHEN THE LUD IS IN THE VARIED OFF STATE.

LUD Modify/Materialize Template

	Element Length	Sub Element Length	Modify Option Value	Materialize Option Value
• State/Status Definition	Char(16)		4001	Z001
- State Change/Status		Char(6)		
Byte 0 --- Bits 0-6 - Reserved		Bit(7)		
Bit 7 - MAT - Active Session State MOD - Activate Session		Bit(1)		
Bytes 1 --- Bit 0 - MAT - Suspend Session State MOD - Suspend Session		Bit(1)		
Bit 1 - MAT - Quiesced Session State MOD - Quiesce Session		Bit(1)		
Bit 2 - MAT - Reset Session State MOD - Reset Session		Bit(1)		
Bit 3 - MAT - Varied On/No Session State MOD - Deactivate Session		Bit(1)		
Bit 4 - MAT - Vary On Pending State MOD - Vary On Command		Bit(1)		
Bit 5 - MAT - Reserved MOD - Vary Off Command		Bit(1)		
Bit 6 - MAT - Power On/Vary Off State MOD - Power On Command		Bit(1)		
Bit 7 - MAT - Powered Off State MOD - Power Off Command		Bit(1)		
Byte 2 Bit 0 - MAT - Diagnostic Mode MOD - Set Diagnostic Mode		Bit(1)		
Bit 1 - MAT - Diagnostic Active Indicator MOD - Reset Diagnostic Mode		Bit(3)		
Bits 2-7 - Reserved		Bit(6)		
Bytes 3-5 --- Reserved		Char(3)		
- Recovery/Resource Activation Definition		Char(2)		
Byte 0 --- Bit 0 - MAT - Inoperative Pending MOD - Reserved		Bit(1)		
Bit 1 - MAT - Normal Pending MOD - Reserved		Bit(1)		
Bit 2 - MAT - Normal Cancel MOD - Cancel		Bit(1)		
Bit 3 - MAT - Normal Continue MOD - Continue		Bit(1)		
Bit 4 - MAT - Normal Activation Pending MOD - Reserved		Bit(1)		

Bit 5	- Reserved	Bit(1)
Bit 6	- Reserved	Bit(1)
Bit 7	- MAT - Normal Active	Bit(1)
	MOD - Reserved	
Byte 1	- Reserved	Char(1)
- Reserved		Char(8)

LUD OBJECT STATE TRANSITIONS

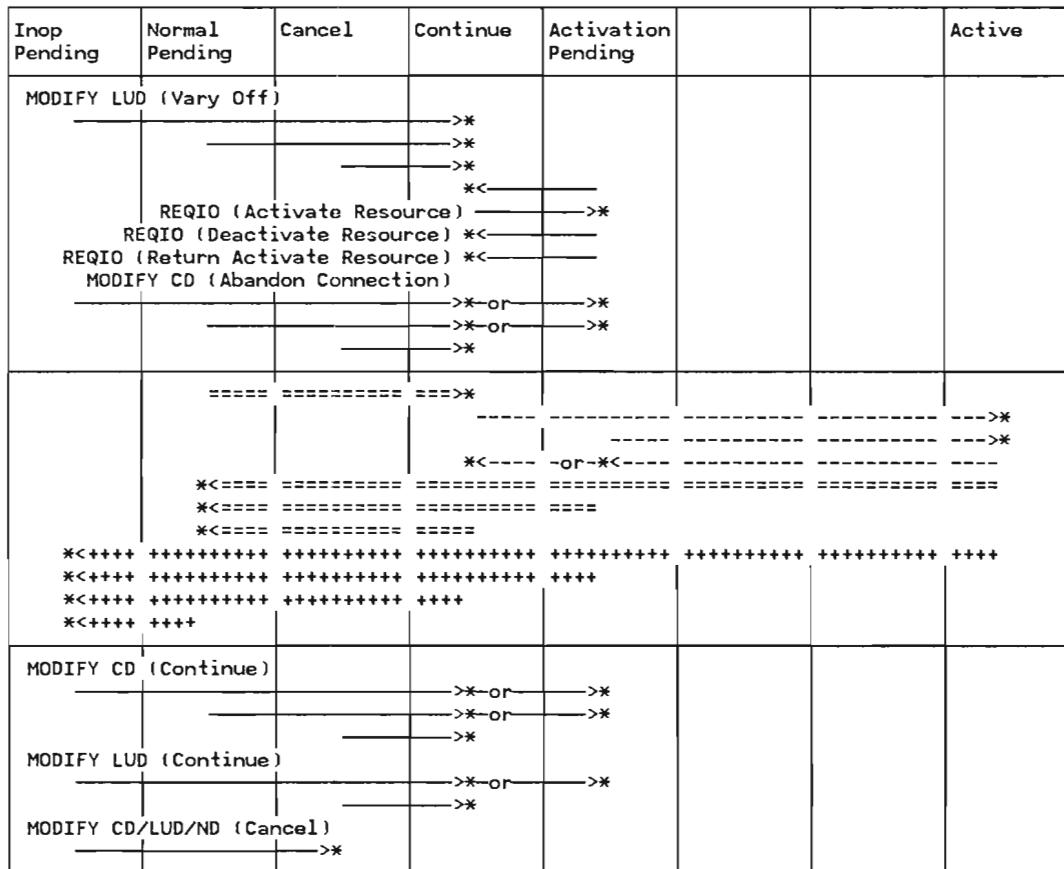


- <—> State transition caused by successful completion of S/S Modify instruction.
- ---> State transition asynchronous to the S/S instruction. Notification of this state change is given via the following events:
 - 000B,06,01 LUD Contact Successful.
- NOTE: Any events not specified will not result in a State transition.

LUD STATE CHANGE RULES

Allowable States for Modification									
Modify Instruction	Diagnostic Mode	Power Off	Power On Varied Off	Varied On Pending	Varied On No Session	Reset	Quiesced	Suspended	Active Session
Vary On	NO	NO	YES	NO	NO	NO	NO	NO	NO
Reset	NO	NO	NO	NO	NO	NO	NO	NO	YES
Quiesce	NO	NO	NO	NO	NO	NO	NO	NO	YES
Suspend	NO	NO	NO	NO	NO	NO	NO	NO	YES
Activate Session	NO	NO	NO	NO	YES	YES	YES	YES	NO
Deactivate Session	NO	NO	NO	NO	NO	YES	YES	YES	YES
CD Abandon Connection	NO	NO	YES	YES	YES	YES	YES	YES	YES
Vary Off	NO	NO	NO	YES	YES	NO	NO	NO	NO
Cancel	NO	NO	NO	YES	YES	YES	YES	YES	YES
Continue	NO	NO	NO	YES	YES	YES	YES	YES	YES

LUD OBJECT RECOVERY/ACTIVATION STATUS TRANSITIONS



- <+++ Status transition asynchronous to the S/S instruction caused by a failure. Notification of this status change is given via the following events:
 - 0004,04,02 CD Contact Unsuccessful "For a Leased Line".
 - 0004,05,01 CD Failure.
 - 000B,08,04 LUD Device Failure "Error Code: '0002'x".
 - 000E,05,01 ND Line Failure.
 - 0017,08,01 Partial System Object Damage set.
- NOTE: Any events not specified will not result in a Status transition.

LUD STATUS CHANGE RULES

Modify Instruction	Allowable Status for Modification					
	Inop Pending	Normal Pending	Cancel	Continue	Activation Pending	Active
Vary On	NO	NO	NO	YES	NO	NO
Reset	YES	YES	YES	YES	YES	YES
Quiesce	YES	YES	YES	YES	YES	YES
Suspend	YES	YES	YES	YES	YES	YES
Activate Session	YES	YES	YES	YES	YES	YES
Deactivate Session	YES	YES	YES	YES	YES	YES
CD Abandon Connection	YES	YES	YES	YES	YES	NO
Vary Off	YES	YES	YES	YES	YES	NO
Cancel	YES	NO	NO	NO	YES-(1)	NO
Continue	YES	NO	YES	NO	YES-(1)	NO

- -(1) Modification allowed if Inoperative Pending status indicated along with Activation Pending status; otherwise "NO".

feedback status indicating the flushed condition and the number of request descriptors processed are set in the Feedback Record. The LU-LU PATH and LU-LU SESSION will have all data purged for this conversation being deactivated. When the necessary synchronization is completed, the CONVERSATION ID is deallocated. If Response is owed, then the active (BOUND) SNA SESSION is unbound (UNBIND code = '320F'X) without using the CHANGE NUMBER OF SESSIONS, BIS, or send error (FMH7) protocols to terminate this session orderly. It is expected that the MI USER will reinstate the session via an ACTIVATE RESOURCE REQIO.

- '84'X RETURN ACTIVATE RESOURCES:
This command is used to flush back to the user's return queue all pending Activate Resource REQIOs, associated with the LUD specified in the SSR, with FBR status indicating the condition. When a CD pointer is

specified, the Activate Resource REQIOs are flushed for all attached LUDs.

'92'X Return RECFMS 00 Alert REQIOs: This subcommand is used to flush back to the user's return queue all RECFMS 00 Alert REQIOs associated with the CD specified in the SSR. The SSR must contain a system pointer to a CE, a system pointer to an MI response queue, and a transmit RD.

The REQIO is passed from MSCP to the LU1/LU6.2 station IOM. The SIOM will return all RECFMS 00 Alert REQIOs with a '480A'X or '4809'X FBR.

MSCP Feedback Record (FBR)

The MSCP follows the standard procedure for signaling the completion of a request. That is, a FBR is generated and sent to the MI response queue specified in the SSR for each REQIO. The two byte error summary field in the FBR contains the appropriate information about completion status for the entire REQIO. The MSCP FBR may include session dependent error status in the optional field provided for this purpose.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
0800			Normal completion	REQIO completed normally; continue normal processing
0814			The "Immediate" Network Resource Activation Operation was specified and the resource is not activated.	The activation of the resource required a connection be established. 1. Change the Network Resource Activation Operation to Normal "Wait On Resource". 2. Reissue the REQIO
0844			Source/Sink data area too small	Correct the data length field in the RU.
4809			REQIO not processed due to MODLUD (Reset), an error on MODLUD (Quiesce), or Return RECFMS 00 Alerts REQIO.	Continue performing the cleanup process.
480A			REQIO not complete due to MODLUD (Reset), an error on MODLUD (Quiesce), or Return RECFMS 00 Alerts REQIO.	Continue performing the cleanup process.
4815			Command Terminated due to Attach Manager session limit exceeded.	The Attach Manager session is in use: 1. Reissue the REQIO when the Attach Manager Session and Conversation is deallocated.
482A			REQIO Activate Resource Immediate was issued and no session is available to satisfy the request.	1. If immediate form was used, re-issue using non-immediate.
6826	3206 UNBIND SENSE CODE AS IN DEV DEP ERROR WITH 'EO1A'X ERROR SUMMARY STATUS	0000 UNBIND SENSE CODE AS IN HARDWARE ERROR WITH 'EO1A'X ERROR SUMMARY STATUS	REQIO (Activate Resource) failed due to BIND negotiation failure and no other sessions exist for this MODENAME. REQIO (Activate Resource) failed due to - RSP received to BIND sent and no other sessions exist for this MODENAME.	Correct incompatibility with remote LU (e.g., configuration problem such as wrong MODENAME), reissue the REQIO.
4830			Invalid object type	The device represented by this LUD does not support an MSCP-LU flow.
4831			REQIO not complete due to the object being in an invalid state of Varied Off.	Allocation of the Resource cannot be accomplished while in these states. 1. Issue the MODLUD/MODCD Vary On command. 2. Reissue the REQIO
4834			REQIO not complete due to the MODCD/ND (Cancel) or MODLUD (Cancel/Vary Off) instruction.	Continue performing the cleanup process.
4835			REQIO not complete due to the Deactivate Resource REQIO.	Continue performing the cleanup process.
4836			REQIO not complete due to the Return Activate Resource REQIO.	Continue performing the cleanup process.
4841			SSD space destroyed	1. Correct user problem (SSD should not be destroyed).

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
				2. Reissue the Request I/O.
4854			REQIO not complete due to the SSCP/PU session not active.	Reissue the REQIO after the session has been established.
4884			REQIO has an Invalid SSD pointer SSD pointer cannot be zero if the data length is not zero.	1. Correct either the SSD pointer or the data length field. 2. Reissue the REQIO.
4887			Invalid Command: 1. RD contains invalid CMD bit combination. 2. Reserved field violation	User program error.
488A			Conversation ID is invalid	The Conversation ID specified is not currently allocated. 1. Correct the Conversation ID 2. Reissue the REQIO
488B			Mode name is invalid or not set.	Reissue the REQIO again with a valid mode name

5.3.4.5 Supervisory Service Events

Several events are defined which require definite action to be taken by an MI process in order to continue normal processing. The handling of these events and servicing of the requests is discussed in the APPC management section 5.7.

5.3.4.6 Exception Codes Signaled for Interconnected Systems

MODIFY ND S/S RESOURCE NOT AVAILABLE EXCEPTION

For communications NDs, the S/S Resource Not Available Exception ('3404'X) can occur on MODIFY ND instructions which attempt the following state changes:

COMMAND	GENERIC	SPECIFIC CODE
VARY ON	'2102'x	Error Code--Activate Line failures. For this case, the corresponding failure event will not have been signaled.
MANUAL ANSWER	'2103'x	Error Code--Initialize Line failures. For this case, the corresponding failure event will have been signaled. '0301'x-- Inoperative Pending or Cancel status set in the ND Recovery Activation status area. For this case, the corresponding failure event will have been signaled.
MANUAL START DATA	'2104'x	None--exception cannot be signaled for this case.
ENABLE SWITCHED LINE	'2105'x	None--exception cannot be signaled for this case.
CONTINUE	'2108'x	Error Code--Initialize Line failures. For this case, the corresponding failure event will have been signaled.
CANCEL	'2109'x	None--exception cannot be signaled for this case.

For each of these cases, the error code will be the same code as is supplied on the corresponding ND failure event as defined in Section- 5.7.6.7. Since the exception error codes for the MODIFY ND instruction will be a subset of those supplied as event data for the ND failure event, the recovery action should be based on the failure event rather than on these exceptions.

MODIFY CD S/S RESOURCE NOT AVAILABLE EXCEPTION

For communications CDs the S/S Resource Not Available Exception ('3404'X) can occur on MODIFY CD instructions which attempt the following state changes:

COMMAND	GENERIC	SPECIFIC CODE
VARY ON	'2202'x	None--Exception will not be signaled for this case.
DIAL OUT	'2204'x	'0401'x--Dial out failure due to all ND candidates in this CD being in use. '0402'x--Inoperative Pending status set in the CD Recovery Activation status area. For this case, the corresponding failure event will have been signaled.
CONTINUE	'2208'x	Switched Lines: None--Exception will not be signaled for this case. Leased Lines: The ND status will be copied into the CD and attached LUDs. '0801'x--Inoperative Pending status set in the ND Recovery Activation status area. For this case, the corresponding failure event will have been signaled. '0802'x--Cancel Status set in ND object.
CANCEL	'2209'x	None--Exception will not be signaled for this case.

MODIFY LUD S/S RESOURCE NOT AVAILABLE EXCEPTION

For communications LUDs the S/S Resource Not Available Exception ('3404'X) can occur on MODIFY LUD instructions which attempt the following state changes:

COMMAND	GENERIC	SPECIFIC CODE
VARY ON	'2302'x	None--Exception will not be signaled.
ACTIVATE	'2303'x	None--Exception will not be signaled.
CONTINUE	'2308'x	The CD status will be copied into the LUD. '1401'x--Inoperative Pending status set in the CD object. For this case, the corresponding failure event will have been signaled. '1402'x--Cancel Status set in CD object.
SUSPEND	'2312'x	'1201'x--Timeout
QUIESCE	'2313'x	'1301'x--Timeout
CANCEL	'2309'x	None--exception cannot be signaled for this case.

SYNCHRONOUS REQIO EXCEPTIONS

The following exceptions will be raised when a Synchronous REQIO is attempted in the following circumstances:

EXCEPTION	GENERIC	SPECIFIC CODE
'3403'X	N/A	N/A - Invalid Object State (Not varied on)
'3401'X	'3402'X	N/A - Invalid Object Type (Not 'PEER')
'3801'X	N/A	N/A - Template Value Invalid (Conversation-ID, RD Subcommand)

5.3.4.7 Modify/Materialize Machine
Attributes(SYSTEMs LUNAME)

FIELD FOR THE System's LUNAME. This field will be used as the PLUNAME in all BIND images sent by the S/38 LU-C Support. It will be the NAME used by other systems to address/route to a particular S/38.

THE MACHINE ATTRIBUTE AREA WILL CONTAIN A CHAR(8)

5.4 WORK STATION CONTROLLER MANAGEMENT (WSC) OR (WSCE)

This section describes the programming considerations and specific device support requirements for work station controller Source/Sink devices. The general information regarding the commands and objects can be found in the instruction sections.

The work station controller management operates on behalf of a work station controller and the logical units (devices) attached to the work station controller. The work station controller management performs the SNA functions necessary to complete a REQIO instruction and to manage data flow to and from the devices (ie, path control, connection point manager, pacing, and data flow control).

5.4.1 WORK STATION CONTROLLER DEVICES SUPPORTED

The work station controller management supports the 5251, 5291, 5292, 5252, 5555, and the 3180 display, the 5219 printer, the 5229 printer, the 5256 printer, the 5224 printer, the 5225 printer, and the 5553 printer.

5.4.2 WORK STATION CONTROLLER LOGICAL UNIT DESCRIPTION (LUD) OBJECT

All work station controller devices require a Logical Unit Description (LUD) object to be created for their support. These LUDs are of a LUD type C'10' for which a Controller Description (CD) object

is required for the LUD's attachment to System/38. All information necessary to create LUDs for each specific work station controller device will be supplied in the subsequent sections. That information which is common to all LUDs, such as name, creation options, forward pointers type definitions, associated space, and etc is defined by the Source/Sink architecture.

5.4.3 WSC DEVICE ATTACHMENT

Only one WSC object configuration exists for attachment of WSC LUD objects to System/38 (see Figure 5.4.3). The LUD type C'10' requires the creation of a CD object. The specific data required in the CD will follow in subsequent sections.

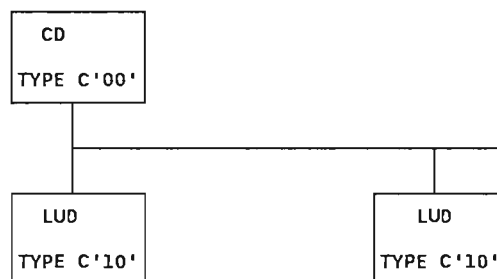


Figure 5.4.3 Work Station Controller Object Configuration

5.4.4 PROGRAMMING CONSIDERATIONS

Communication with a work station controller or device is accomplished through SNA paths. An MSCP-PU path is activated when the WSC is varied on, an MSCP-LU path is activated when the LU is varied on, and an LU-LU path is activated when a MODLUD (activate) is executed. To manage these SNA paths the device management supports the following MI commands.

```
MODCD:  Vary On/Off
        Continue/Cancel
MODLUD:  Vary On/Off
        Activate/Deactivate
        Suspend
        Quiesce
        Reset
        Device Specific Contents
        Continue/Cancel

REQIO:   Functions - Normal
                  MSCP
        Control - Normal
                  Continue
```

Prior to using any of these commands, the user must create the controller object describing the work station controller and the LUDs describing the device(s). This is done by using the following MI support code instructions:

```
CRTCD - Create Controller Descriptor
CRTLUD - Create Logical Unit Descriptor
```

See the appropriate instruction writeups for the template data needed to create the CD and LUD(s) for the work station controller or supported device(s).

5.4.4.1 MI Commands

MODCD (VARY ON/OFF)

This command is used to establish or break the communication path to the physical unit in the work station controller represented by the CD.

MODCD (CANCEL)

This command is used to suspend the reconnection and reuse of the controller.

MODCD (CONTINUE)

This command is used to enable the reuse of the controller and to request that contact be re-established after an unrecoverable error has occurred.

MODCD (UNIT SPECIFIC CONTENTS)

This command is used to force a RAM Contents List reset of an IGC user defined character for KANJI devices attached to KANJI controllers.

MODLUD (VARY ON/OFF)

This command is used to establish or break the communication path from the MSCP to the LU. It also performs preliminary setup for the LU-LU path.

MODLUD (ACTIVATE/DEACTIVATE)

This command is used to establish or break the communication path from the System/38 LU to the WSC's LU. MODLUD (activate) is also used to activate the LU-LU path when it is in any one of the three inactive states (suspended, quiesced, or reset).

MODLUD (QUIESCE)

Once the native display adapter management receives this request, it will complete all REQIOs that are in progress or waiting on the internal LU queue. Upon completion of this command, the device management will come to a normal completion and all REQIO processing is discontinued until the path is reactivated with a MODLUD (activate) command.

The quiesce is completed with a rejected status in four situations. The first is that the unit is already in a terminating error mode upon receipt of the quiesce. The second is that the unit drops into the terminating error mode while trying to complete the quiesce. The third is when the quiesce cannot complete within the timeout value specified due to a long running REQIO in process. The fourth is when the unit is in error recovery upon receipt of the quiesce. In these situations, the user must analyze the feedback record(s) that is on his return queue and perform the necessary recovery for the error situation.

Note: If this command is issued when there exists a REQIO with a transmit containing a Read from Device command, the WSC management is unaware of the Read command. Therefore, the completion of Quiesce is dependent on the device operator hitting enter.

MODLUD (RESET)

This command causes all REQIOs to be flushed back to the user's return queue, in an orderly fashion, with a feedback status indicating the flushed condition. The number of request descriptors processed will also be set in the feedback record. This command also places the path in an inactive state, which can be reactivated with a MODLUD (activate) command. All available unsolicited data is discarded by this command.

Note: If a MODLUD(RESET) command was issued for a printer device, all outstanding REQIO's are returned to the user's return queue. Also, the

MODLUD(ACTIVATE) command must be followed by a REQIO (UNBIND) command in order to clear the printer device. All unsolicited data will be discarded until a successful response to the UNBIND is received. (Refer to SNA documentation for definitions of BIND, UNBIND commands which are defined for the device within the SNA-RU.)

For displays, it is possible for the reset to cause partial damage to the LUD. This would happen if the reset were issued with a timeout value specified which is shorter than the time needed to complete a transmit to hardware. For printers, the reset cannot timeout because the outstanding REQIO's are returned immediately (no hardware wait).

MODLUD (SUSPEND)

This command ensures the user that all REQIOs for this logical unit are in the suspended state. This means that all the REQIOs that have been started will be completed to a transmit/receive request descriptor boundary. The REQIOs that are completed will be placed on the return queue with the appropriate feedback code and number of RDs done. Any transmit/receive type of REQIO with only the transmits complete will still be on the logical units queue. The suspend may be completed with a reject status if the suspend cannot complete within the timeout value specified due to a long running REQIO in process.

Note: It is possible for MODLUD (suspend) to complete normally and the logical unit to be placed in terminating error mode. Therefore, it is recommended that the user check the queue for any feedback records indicating a terminating error condition.

MODLUD (SUSPEND, DEACTIVATE, AND ACTIVATE)

This combination of MODLUD commands can be executed to perform a logical unit 'Save' type of operation. This atomic set of commands will perform a suspend, reset, deactivate, and activate. Therefore, the user is guaranteed that all REQIOs are called back and placed on the user's queue and that the logical unit is in an active path state ready for a new set of REQIOs to process.

Note: A reset causes any available unsolicited data to be relinquished, as the device management has no way to give the data to the user.

MODLUD (DEVICE SPECIFIC CONTENTS)

The Device Specific Contents field within the LUD objects for Work Station Controller devices 5251 and 5252 contains a Format Table Length field and for the 5256 device it contains a Number of Print Buffers field. These fields can be modified at any point in time since this is a general capability for all LUDs. However, for the case of the Work Station Controller devices, these fields are used only at the time of VARY ON CD to initialize the hardware

for all LUDs attached to this CD. If these LUD fields are modified after the CD is varied on, the new values will not take effect until the next VARY ON CD.

MODCD (UNIT SPECIFIC CONTENTS-RAM CONTENTS LIST RESET)

This command is used to reset an extension character in the RAM Contents List of each Kanji device attached to this controller. A subsequent output data stream containing the extension character will result in a VMC reference to the IGC table defining this character to insure that the latest image is portrayed correctly at the device.

MODLUD (CANCEL)

This command is used to suspend the device after an unrecoverable error.

MODLUD (CONTINUE)

This command is used to enable the reuse of the device after an unrecoverable error.

REQIO

This command is used for two purposes. First, it is used to perform I/O on the various paths (MSCP-to-physical unit, MSCP-to-logical unit, and logical unit-to-logical unit). Second, the REQIO (continue) is used to return the logical unit to active path state after it has encountered a terminating error.

Refer to the Request I/O instruction for details on the REQIO command and its source/sink request object.

- Note:
1. A REQIO transmit only on the ANY flow defaults to a REQIO transmit only on the NORMAL flow. (See SSR function below.)
 2. All transmit RUs should be double-word aligned and should not cross SID boundaries. The device management will take care of these situations but the user will encounter a performance degradation.
 3. One REQIO cannot contain more than 15 Transmit RDs if it is to be sent to a display.
 4. The display REQIO Transmit RDs must begin with an RH containing 'begin chain' and end with an RH containing 'end chain' (ie, full SNA chains only).

Device Management Source/Sink Request (SSR) General

The SSR Function field bits have the following meanings for device management.

Bits 0-3 same as described in MI Vol III.

Bits 4-5: These bits define the SNA flow for which all the Request Descriptors are to be processed on. The values and their meanings are:

- 00 & 10 - These combinations indicate that the RDs are to flow on the SNA normal flow.
- 01 - This combination indicates that the RDs are to flow on the SNA expedited flow.
- 11 - This combination indicates that the RDs are to flow on either the SNA expedited or Normal flow (ie, it implements a receive any function). Note: This bit setting is changed to 10 (normal flow) if the first RD is a transmit RD.

Bits 6-7 Reserved (binary zero)

The SSR OPTIONAL POINTER field has the following meaning for the KANJI/Ideographic work station controller:

Bytes 0-3 : SSD offset of RAM Contents List Save Area. When doing the SAVE part of the display SAVE/RESTORE function, the RAM Contents List is saved in the SSD by VMC so that it can be restored with the RESTORE part of the SAVE/RESTORE function. This save area in the SSD must be 2,574 bytes in length.

Bytes 4-5 : Flag bytes:

- Bit 0 : Clear Unit Indicator. Turned on for display output that erases or clears the entire screen, even if the same output also writes to the screen thereafter.
- Bit 1 : Extension Characters Processing Indicator. Turned on to enable the Extension Character IOM functions of scanning the IGC data for Extension Characters and managing the ideographic device RAM.
- Bit 2 : Printer Direct Output Indicator. Turned on to indicate that the Printer FM is doing direct output (as opposed to spooled), which causes the Extension Character IOM to restore the output data to its original form at REQIO feedback time. (Data may be overlayed with RAM addresses during output.)
- Bit 3 : User defined data indicator. Turned on to indicate that the user (as opposed to CPF) has inserted device control characters into the data stream. Used by the Extension Character IOM as an

indication that the ideographic device RAM may be altered by the user.

Bits 4-15: Reserved

Bytes 0-5 are all set by CPF and passed to VMC as control parameters.

Bytes 6-15 : Used internally by the WSC IOM while processing the REQIO, but not passed through the machine interface.

Device Management Request Descriptor

This request descriptor (RD) is used for communications devices. In SNA terms, the RD contains information for the transmission header (TH) and the request/response header (RH). The RD also provides for the length and location of the request/response unit (RU) in the source/sink data area (SSD). Both transmit and receive RDs may be specified in the SSR but all of the transmit RDs must precede any receive RDs. The fields in the RD are described below:

Request Descriptor (RD) Layout

RU Flow Type	Reserved	Sequence #	RU Length	RH	Reserved	RU Offset
0	1	4	6	8	11	12

RU Flow Type - Char(1):

Bit 0 of the RU flow type indicates whether this is a transmit or receive RD
 Bit 0 = 0 Transmit RD
 Bit 0 = 1 Receive RD

Bit 1 indicates whether the RD has been processed by the machine or is awaiting processing. Device management ensures that this bit is set to zero upon receipt of the REQIO. This bit may not be used by the user to cause device management to skip the RD. Device management always assumes that all the RDs in the REQIO are to be processed. In a terminating or non-terminating error situation, the RD completion count will point to the RD on which the error was discovered. This RD will be marked processed.
 The values are: Bit 1 = 0 - not processed
 Bit 1 = 1 - processed

Bits 2-3 are reserved and must be binary zeros

Bit 4 indicates whether or not this is a transmit or receive immediate RD.
 Bit 4 = 0 normal I/O operation
 Bit 4 = 1 immediate RD

Bits 5-7 are reserved and must be binary zero. (Note - bits 6-7 are used internally by the WSC IOM for Kanji devices.)

Reserved - Char(3) - must be binary zeros (Note - first byte used internally by IGC.)

Sequence Number Field - Bin (2) - The two byte binary sequence number is assigned and controlled by the machine. For a transmit RD, the machine assigns a sequence number and inserts it into the sequence number field. For a receive RD, the machine inserts the received sequence number into the sequence field.

Note: This field is not used by device management for it is not supported in SNA-0081 protocols.

Request/Response Unit (RU) Length - Bin (2) - For a transmit RD, this field contains the length of the output RU. A length of zero indicates there is no RU associated with this RD. For a receive RD, before it is processed, this field specifies the space available in the SSD for the RU. After the receive RD is processed, this field contains the length of the received RU. If a group of receive RDs is specified in the SSR, the space available for all of the RUs can be specified in the first RD of the group. The RU length field in the remaining RDs of the group is set to zero. When the RDs in the group are processed by the machine, the RU length and offset fields are updated to the length and offset of the received RUs. The SSR can have more than one group of receive RDs. The RUs for all RDs in the SSR must be located in the same SSD.

Request/Response Header - Char(3) - These three bytes contain the information for the request/response header (RH). For a send RD, the information for the outbound RH is supplied to the machine in this field. For a receive RD, the information from the received RH is inserted in this field when the RD is processed by the machine. All unused bits are identified as reserved and must be set to zero.

Byte 0 of the Request Header:

Bit 0=0 indicates this RU is an SNA request.

Bits 1-2 are used to identify which of the four types of RU are being processed. The combinations of bits and their meanings are:

- 00 - Function Manager Data (FMD)
- 01 - Network Control
- 10 - Data Flow Control
- 11 - Session Control

Bit 3 is reserved (binary zero)

Bit 4 indicates which of the formats is used in the associated RU. The use of formats is session and RU type dependent (see SNA 0081). One use of this bit is to indicate the presence of an FM header in the RU.

Bit 5=0 indicates a valid request.

Bit 5=1 indicates the first four bytes of the RU are sense data for an Exception Request.

Bits 6-7 indicate which element of a chain of RUs is being sent. The bit settings are:

- 00 - Middle of chain
- 01 - Last of chain
- 10 - First of chain
- 11 - Only in chain

Byte 1 of the Request Header:

Bits 0-2-3 - These three bits are used in combination to specify the type of response required. Bit 0 is always one (except IPRs) and Bit 2 is always zero for SNA 0081 implementation. If Bit 3 is zero, a definite response must be sent. If Bit 3 is one (exception response mode), a negative response is sent only if an error is encountered, otherwise no response is sent.

Bit 1 is reserved (binary zero)

Bits 4-6 are reserved (binary zero)

Bit 7 - this bit specifies pacing control. It may be specified as zero. Device management within the machine will ensure that it contains the correct setting when the request header is transmitted to the device.

Byte 2 of the Request Header:

Bits 0-1 - these bits are used for bracket control. Brackets are not used by the devices attached to the WSC. These bits must be binary zero.

Bit 2 - This bit, a change direction indicator, is used in a half duplex environment to control the orderly transmission of messages.

Bit 2=0 means do not change direction

Bit 2=1 means change direction

Bit 3 - Reserved (binary zero)

Bit 4 - The code selection indicator is not used by the WSC. It must be set to binary zero.

Bits 5-7 are reserved (binary zero)

Byte 0 of the Response Header:

Bit 0=1 indicates this RU is an SNA response.

Bits 1-2 are used to identify which of the four types of RU are being processed.

- 00 - Function Manager Data (FMD)
- 01 - Network Control
- 10 - Data Flow Control
- 11 - Session Control

Bit 3 is Reserved (binary zero)

Bit 4 - Same as for Requests

Bit 5=0 indicates that no sense data is included

Bit 5=1 indicates that the first four bytes of the RU contain SNA sense data.

Bits 6-7 indicate which element of a chain of RUs is being received. The Bit settings are:

- 00 - Middle of chain
- 01 - Last of chain
- 10 - First of chain
- 11 - Only in chain

Byte 1 of Response Header

Bit 0 is the same as the corresponding request header bit

Bit 1 reserved (binary zero)

Bit 2 is the same as the corresponding request header bit.

Bit 3=0 indicates a positive response

Bit 3=1 indicates a negative response.

Bits 4-6 reserved (binary zero)

Bit 7 indicates a pacing response from the terminal.

Byte 2 of Response Header

All of byte 2 is reserved (binary zero)

Reserved Char (1) - Always set to binary zeros.

RU Offset - Bin(4) - The four byte RU offset is a displacement, in bytes, to the beginning of an RU from the beginning of the SSD space. An RU associated with a specific RD can be located by displacing into the SSD space an amount equivalent to the RU offset. The RU offset for a receive RD is updated by the machine if the RU length in the RD is specified as zero (ie, the RD is designated as a part of an RD group. See RU length description).

NOTE: It is strongly recommended that the offsets for Transmit RDs point to RUs on doubleword boundaries and the RU does not cross a SID boundary. If the above situations do occur, the device management will allocate storage and move the RU data. This action will degrade performance considerably. These alignments are required by the machines operational units.

Source/Sink Data (SSD) Contents

The SSD for the Device Management RDs contains RUs as defined by the RDs location in the SSR. One RD defines one RU. The location of the RU within the SSD is determined by the RU offset field in the RD. For transmit RDs, the offset must be supplied to the machine in the RD. For receive RDs, the offset can be supplied for each RD or the offset can be supplied for the first RD of a group and the machine determines the offset for each subsequent RD in the group based on the length of the received RU. A receive RD is considered a member of a group if its RU length is zero. More than one group of receive RDs can be specified in an SSR but all of the RUs for those RDs must be located in one SSD.

RU Contents

In general the RU (request/response unit) contents are not described for devices (Logical Units) attached through local work station support since the LU layer of SNA support is generally above the machine interface and as such the user and the end device have responsibility for that level of protocol while the machine provides the carrier functions (SNA transmission subsystem). Exceptions to this philosophy exist for those cases where the work station controller must provide the Logical Unit (LU) status which the remote controller would otherwise have generated on behalf of its attached devices. These status or sense codes are SNA defined and are provided back above MI in RU's defined for that purpose.

5.4.4.2 Feedback Record

Device management supports the feedback record as described in the Request I/O instruction. The feedback information for device management consists of the error summary field and the number of RDs processed. For non-KANJI, all other status fields are not used by the Work Station Controller management. For the KANJI/Ideographic Work Station Controller, the Feedback Record Format is the same as for non-KANJI for all Feedback codes listed below except for codes '702C'X and 'F02C'X. For these two cases, the Feedback Record format is given in Table I.

The following table gives the error conditions, the severity code, and recovery procedures. The severity codes are returned in the error summary field.

Note: All feedback codes may have the MSCP bit on in the SSR Function field. This bit is turned on only if the REQIO function field indicates an MSCP REQIO (eg, normal completion for an MSCP REQIO is '0800'X instead of '0000'X).

<u>CODE/SEVERITY</u>	<u>ERROR CONDITION</u>	<u>RECOVERY PROCEDURE</u>
0000/Normal	Normal completion	REQIO completed normally; continue normal processing
0008/Normal	REQIO continue normal completion	REQIO continue completed normally; station no longer in terminating error mode. Continue normal processing.
0018/Normal	REQIO receive immediate completed with no un- solicited data received on SNA immediate flow.	No unsolicited data was available to return with REQIO. Continue processing.
0044/Normal	Source/Sink data area too small - The current request descriptor has an SSD remaining length field that is smaller than the RU received from the station.	1. Handle this feedback as if it were an event for unsolicited data. 2. Send device manage- ment a REQIO to pick up the data. 3. If data is not desired, do a MODLUD (Reset, Activate). NOTE: This also re- calls all outstanding REQIO's for this Logical Unit and purges all un- solicited data.
4009/Non-termin- ating	REQIO partially complete due to the execution of the MODLUD (Reset) command. Some RDs were processed.	Continue performing the reset cleanup process.
400A/Non-termin- ating	REQIO complete due to the execution of a MODLUD (Reset) command. No RDs were processed.	Continue performing the cleanup process.
4031/Non-termin- ating	An MI command, REQIO was executed and there was no trace of the object being Varied On.	Vary On the object. This code should never be used as the REQIO instruction will raise an invalid state exception.
4088/Non-termin- ating	Invalid RD sequence. A sequence of transmit/ receive/transmit is not allowed in a REQIO operation	Split the REQIO operation into two REQIO operations. First one does transmit/ receive. Second one does the remaining trans- mits. NOTE: WSC REQIOs can only be of the following variety. Transmit only Transmit & Receive Receive only
C00B/Terminating	Partial Damage	Vary off the CD and LUNs to clear this condition.

CODE/SEVERITY	ERROR CONDITION	RECOVERY PROCEDURE
		A partial damage event for CD and/or LUDs has also been signaled.
C022/Terminating	Station/Terminal failure. The station/terminal has encountered a catastrophic error.	1. The LU (terminal) receiving this feed back code must be Varied Off. If the CD failure event is received, the station must be Varied Off only after each LUD has been Varied Off. 2. For station failure, the specific reason may be obtained by listening for: CD Event X'0004' Type X'05' Subtype X'01' 3. The error is also recorded in the error log.
C041/Terminating	SSD destroyed.	Provide a correct SSD, perform any higher level recovery which is necessary if data has been lost, then reissue the REQIO, and issue a REQIO-continue.
C045/Terminating	REQIO has an RD in it that specifies an output RU that is larger than the allowable RU size for this controller	Set the correct RU size in the RD. Reissue the REQIO.
C054/Terminating	REQIO for LU-LU session attempted prior to session being bound.	1 Issue REQIO continue to reset the terminating error condition. 2 Continue to cleanup session.
C084/Terminating	REQIO has an invalid SSD pointer. SSD pointer cannot be zero if the data length is not zero.	Correct either the SSD pointer or the data length field.
C086/Terminating	REQIO, sent to a display device, has more than 15 transmit RDs in it.	Structure the REQIOs so there are no more than 15 transmit RDs.
C087/Terminating	REQIO, sent to a display device, was not a complete SNA chain.	Make all REQIOs sent to displays, a complete SNA chain
702C/Non-Terminating	KANJI/IGC data stream error. Specific information is given in the Device Dependent Status area.	1. Inform the user who is responsible for the content of the data. 2. The data is sent out anyway, as if normal, to display or print whatever the device can

CODE/SEVERITY	ERROR CONDITION	RECOVERY PROCEDURE
		handle.
F02C/Terminating	KANJI/IGC interface error. Specific information is given in the Device Dependent Status area.	1. Correct the error. Re-issue the REQIO. 2. The error is also recorded in the error log.

Note: Terminating error severity requires the user to use a REQIO (continue) command to bring the path back to an active path state or a MODLUD (reset, activate) to clear the path for normal traffic.

Table I:

Format of the Feedback Record for the KANJI/Ideographic Work Station Controller when the error summary field is either '702C'X or 'F02C'X:

Bytes 00-15	S/S Request Address	(No change)
Bytes 16-17	Request ID	(No change)
Bytes 18-19	Error Summary	'702C'X or 'F02C'X
Bytes 20-21	RD Number	(No change)
Bytes 22-23	RIU Segment Count	(No change)
Bytes 24-63	Device Dependent Area	
Bytes 24-25	Binary zeros	
Bytes 26-27	Binary zeros	
Bytes 28-35	Binary zeros	
Bytes 36-37	Binary zeros	
Bytes 38-63	Device Defined Data	
Bytes 38-39	Error Code	(See table below)
Bytes 40-41	Sub-category	(See table below)
Bytes 42-43	Extension Character	(See table below)
	or RAM Address	
Bytes 44-47	Data offset	(See table below)
Bytes 48-63	Reserved	

BYTES: 18-19 38-39

40-41

42-43

44-47

Error Summary	Error Code	Error Description	Sub-Category	EX. CHAR/ RAM @	DATA OFFSET
702C	D010	True RAM Full	0001: in Write Data	Ex. Char.	Data Offset
			0002: in Read Data	Ex. Char.	Data Offset
702C	D012	Invalid Character in Input Data Stream	0001: Unrecognizable char - .LT X'40'	0000	Data Offset
			0002: Attribute found in IGC mode	0000	Data Offset
			0003: Not READ MDT cmd and X'11' found, or READ MDT cmd and X'11' in IGC field	0000	Data Offset
			0004: SO in IGC field	0000	Data Offset
			0005: SI in ANK field	0000	Data Offset
			0006: Odd number of nulls in IGC field	0000	Data Offset
			0007: Odd number of X'1C's in IGC field	0000	Data Offset
702C	D013	Undefined Extension Character on Output	0001: In Display Data	Ex. Char.	Data Offset
			0002: In Printer Data	Ex. Char.	Data Offset
			0003: In Restore Data	Ex. Char.	Data Offset
702C	D014	Invalid IGC Character on Output	0001: Invalid Point	Ex. Char.	Data Offset
			0002: Invalid Ward	Ex. Char.	Data Offset
702C	D015	Unmatched SO on Input	0001: No SI to match SO	0000	00000000
702C	D016	Unmatched SO on Output	0001: Write to display	0000	00000000
			0002: Write Error Code	0000	00000000
702C	D017	Invalid 5250 Display Control Character on Output	0001: Unrecognizable Char - .LT X'40' in IGC field	0000	Data Offset
			0002: Attribute found in IGC field	0000	Data Offset
			0003: X'04' - not found when expected X'04XX' - XX not recognized command or other invalid not listed below	0000	Data Offset
			0004: X'04', then end of data before end of cmd	0000	Data Offset

BYTES: 18-19 38-39

40-41

42-43

44-47

Error Summary	Error Code	Error Description	Sub-Category	EX. CHAR/ RAM @	DATA OFFSET
			0005: SO in IGC field	0000	Data Offset
			0006: SI in ANK field	0000	Data Offset
			0007: Odd number of nulls in IGC field	0000	Data Offset
			0008: Invalid syntax in Start of Field order	0000	Data Offset
			0009: Error in ECSCAN	0000	Data Offset
			0010: RESTORE cmd encountered with another command	0000	Data Offset
			0011: Odd number of X'1C's in IGC field	0000	Data Offset
702C	D018	Invalid Printer Control Character	0001: Invalid SCS control character	0000	Data Offset
			0002: Error in ECSCAN	0000	Data Offset
F02C	D019	Invalid RAM Address	0001: Input RAM address is out of hardware range	RAM@	Data Offset
			0002: Input RAM address maps to RCL entry with no Ex. Char.	RAM@	Data Offset
F02C	0020	RAM Contents List Missing in REQIO Save Area (RESTORE side of SAVE/RESTORE)	0001: No RCL in Save Area 0002: No RCL save area allocated	0000	00000000
F02C	D021	REQIO Save Area Invalid (SAVE side of SAVE/RESTORE)	0001: No RCL Save area allocated	0000	00000000

Note: Data Offset is SSD offset if output, and input buffer offset if input.

5.4.4.3 Events Raised By Work Station Controller Support

LUD EVENTS

Supervisory Services Request Event: (000B 04 01,02)

This event is signaled whenever any SNA FM data request is received by the MSCP. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details. The RU data provided by Work Station Controller devices for these events consist of up to 80 bytes as indicated in the data length field of the event.

Unsolicited Data Event: (000B 05 01,02)

Type: 05. This LUD event indicates that unsolicited data is available for this LU.

Subtype: 01. The data is on the expedited SNA flow.

02. The data is on the normal SNA flow.

This event is raised only for the first frame received and any time there is not a REQIO outstanding with enough receive RDs available to contain the unsolicited data.

LUD Contact Event: (000B 06 01,02)

This event is signaled when the LUD vary on processing is completed by the MSCP. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details. Subtype 01 is signaled upon successful contact, however, subtype 02 (unsuccessful case) is never signaled for WSC devices. In these cases, the MODIFY LUD (VARY ON) instruction signals an exception instead.

LUD Failure Event: (000B 08 01,02)

Type: 08 The device failure event is signaled whenever a VARYed ON device goes to a state where it can no longer be used.

Subtype: 01 Never signaled on behalf of Work Station Controller devices.

Subtype: 02 Signaled when an SNA LUSTAT request is received on the MSCP-LU session indicating that the device is not available. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details.

REQIO Complete Event: (000B 09 01)

This LUD event indicates that the REQIO asynchronous processing is completed. It is signaled only if the user requests it.

Queue Destroyed Event: (000B 0A 01)

This LUD event indicates that the return queue specified in the REQIO instruction has been

destroyed. Note: This LU path is also placed in terminating error mode.

CD EVENTS

CD Contact Event: (0004 04 01)

This event is signaled when the CD vary on processing is completed by the MSCP. Refer to MSCP Section 5.1.2 and Event Section 8.1.1 for details. Subtype 01 is signaled upon successful contact, however subtype 02 (unsuccessful) or subtype 03 (loss of contact) are never signaled for WSC controllers. In these cases, the MODIFY CD (VARY ON) instruction signals an exception instead and the CD Failure Event will be signaled also.

Controller Failure Event: (0004 05 01,02)

Type: 05. This CD event indicates a CD failure. A list of error codes for both subtypes is defined in Section 5.3 of this document. This error code will be supplied in the first two bytes of the event related data along with a timestamp and OU number for both event subtypes.

Subtype: 01. Inoperative. The work station controller is not capable of normal operation. For one of the cases, where the error code reported is 0405, the optional pointer in the event related data will be a system pointer to the LUD attached to this CD which has experienced the problem with invalid data in the LUD Device Specific Area. Also, codes 0303, 0305 and 9998 never cause this event to be signaled.

Subtype: 02. Protocol violation. Data was received from a device and the LU was not varied on or the path not activated. Only error codes 0801 and 8004 are signaled for this event.

5.4.4.4 Exception Codes Signaled by WSC Support

MODIFY CD EXCEPTION CODES FOR RESOURCE NOT AVAILABLE

For the Work Station Controller CD object, the S/S Resource Not Available Exception ('3404'X) is only raised by the MODIFY CD instruction for a VARY ON operation.

COMMAND	EXCEPTION DATA	
	GENERIC	SPECIFIC CODE
VARY ON	'2202'X	The CD failure event has not been signaled for this case.

MODIFY LUD EXCEPTION CODES FOR RESOURCE NOT AVAILABLE

For the LUDs attached to Work Station controllers, the S/S resource not available exception ('3404'X) is raised by the MODIFY LUD instruction for the following state change modifications:

COMMAND	EXCEPTION DATA	
	GENERIC	SPECIFIC CODE
VARY ON	'2302'X	None--exception will not be signaled
ACTIVATE	'2303'X	None--exception will not be signaled
ACTIVATE after suspend, quiesce or reset (RESUME)	'2311'X	None--exception will not be signaled
SUSPEND	'2312'X	'1201'X--Suspend was rejected since the suspend could not complete within the timeout value specified.
QUIESCE	'2313'X	'1302'X--Quiesce rejected due to terminating error condition (on REQIO) '1301'X--Quiesce was rejected since the quiesce could not complete within the timeout value specified.

5.4.5 OBJECT CREATION DATA FOR SUPPORTED DEVICES

This section defines the data needed to create the objects necessary to attach a specific device to the System/38. There is a section for each device supported.

5.4.5.1 CD Template Data for Work Station Controller

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
CD Type	Controller descriptor that is not attached to an 'ND'.	Char(2)	'00'C
Unit Type	The controllers IBM product number	Char(4)	'WSC 'C - Non-extended Work Station Controller (ROS version - pre-Release 5) 'WSCE'C - Extended Work Station Controller (RAM)
Model Number	The controllers model	Char(4)	All blanks
Physical Address	Controllers complete network Address	Char(8)	
• Reserved	These four bytes always zero	Bin(4)	'00000000'X
• Station's line address	Always zero for work station controller	Bin(2)	'0000'X
• Operational Unit #(OU#)	Controller's OU#	Bin(2)	'0030'X, '0070'X, '00B0'X or '00F0'X
Power Control	N/A	Char(2)	'0000'X
Station Control Information	This data describes the station and its operating modes	Char(32)	
• XID Information	Layout directly from SNA	Char(21)	
- XID format	N/A	Bit(4)	'0000'B
- Physical Unit Type (PU)	N/A	Bit(4)	'0000'B
- XID Information Length	N/A	Bit(8)	'00'X
- Station's Name		Char(4)	
Block #	Manufacturing assigned product number	Bit(12)	'000'X
Specific ID	User assigned ID	Bit(20)	
- Reserved		Char(4)	'00000000'X
- Maximum Length received	N/A	Bin(2)	'0000'X
- Reserved		Char(4)	'00000000'X
- Frames Limit	N/A	Bit(8)	'0000'X
- Reserved		Char(4)	'00000000'X
• Station Definition	Defines the type of connection and role played by the work station controller.	Char(1)	'00'X
• Reserved		Char(2)	'0000'X
• Path Information Unit	N/A	Bin(2)	'0000'X
• Reserved		Char(6)	binary zero
Selected Modes	N/A	Char(16)	binary zero

Activate Physical Unit Data	N/A	Char(16)	All Binary Zeros
Dial Digits		Char(32)	All Binary Zeros
Specific Characteristics	N/A	Bin(2)	'0000'X
XID Information Area			
• Length of XID Data	N/A	Bin(2)	'0000'X
Unit Specific Contents			
For Unit Type = 'WSC' or Unit Type = 'WSCE' and Unit Specific Area Ram Load Option = '0001'X:			
• Unit Specific Lengths	Length of Area	Bin(2)	'0002'X
	Length of Modifiable Area	Bin(2)	'0002'X
• Unit Specific Area	RAM Load Option	Bit(16)	For Unit Type = 'WSCE': '0001'X - Standard (Non-IGC) WSC RAM LOAD For Unit Type = 'WSC': '0000'X
For Unit Type = 'WSCE' and Unit Specific Area Ram Load Option = '0002'X:			
• Unit Specific Lengths	Length of Area	Bin(2)	'0008'X
	Length of Modifiable Area	Bin(2)	'0008'X
• Unit Specific Area	RAM Load Option	Bit(16)	'0002'X IGC WSC RAM LOAD
	Character Generation Utility (CGU) Update Parameters	Bit(48) *	
	Options	Bit(1) Bit(15)	'1'B - CGU Update Reserved
	Extension Character Ward	Bit(8)	'56'X thru '7F'X
	Extension Character Point	Bit(8)	'41'X thru 'FE'X
	Extension Character Size	Bit(16)	'0012'X - 18 X 18 Dot Matrix '0018'X - 24 X 24 Dot Matrix
* CGU Update Parameters Are Used Only on the Modify CD Unit Specific Contents command (operand 3 of MODCD command = 4010). On all other commands, the CGU update parameters are not used and should be set to zeros.			

5.4.5.2 LUD Template Data for the 5251, 5252, 5291, 5292, 5555, or 3180 Display

Field Name	Description	Length	Data
LUD Type	Logical unit that is attached to a CD	Char(2)	'10'C
Device Type	The devices IBM product number	Char(4)	'5251' or '5252' or '5291' or '5555' or '5292' or '3180'

Note: 5251-0001 and 5252-0001 not allowed to attach to WSC-E controllers. 3180-0002 allowed only to attach to WSC-E controllers.

Model Number	The devices model number	Char(4)	-'0001'C for 960 character screen 5251 -'0011'C for 1920 character screen 5251 -'0001'C for 960 character screen 5252 -'0001'C for 5291 -'0001'C for 5292 -'0002'C for 5292-2 -' B01'C for 1920 character screen 5555 -'0002'C for 3180
Physical Address	Logical units complete network address	Char(8)	
• Reserved	These two bytes always zero	Bin(2)	'0000'X
• LU Address (DAF)	Destination address of the display head or printer (LSID) Note: Select the lowest number for the first LUD created. Best performance is obtained when LSIDs are assigned contiguously for each succeeding LUD starting with LSID '0000'X.	Bin(2)	'0000'X-'0013'X if attached to WSC controller '0000'X-'001F'X if attached to WSCE controller
• Station Line Address		Bin(2)	'0000'X
• OU# Same # as in CD	OU# of WSC this LU Attaches to	Bin(2)	'0030'X, '0070'X, '00B0'X or '00F0'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	
• Inbound Pacing	Defines # transmissions before a pacing response is needed. Pacing term to host. Always binary zero: no pacing in this direction.	Bin(2)	'0000'X
• Outbound Pacing	Defines # transmissions before a pacing response is needed. Pacing host to term. Always a binary zero for displays: no pacing.	Bin(2)	'0000'X
• RU Buffer Size	Maximum Request Unit length Note: Select 256 byte RUs for 5251 model 2 or 12 compatibility operation of the WSC displays.	Bin(2)	'0C00'X = 3072 bytes '0100'X=256 bytes
• ACTLU	Indicates that the display needs an ACTLU to be activated.	Char(1)	'01'X
• ACTLU Para-	SNA ACTLU data for the dis-	Char(3)	'0D0101'X

meters	play		
• ACTLU Response	Return area for ACTLU Response	Char(8)	All binary zeros
Load/Dump Indicator	N/A	Char(16)	All Binary Zeros
Specific Characteristics	Length of specific characteristics area	Bin(2)	'0014'X-20 bytes
	Device descriptor	Bit(16)	'0041'X for 5252 & '0081'X for 5251 Model 0001 & '00C2'X for 5251 Model 0011, 5291 Model 0001 5292 Models 0001 & 0002 3180 Model 0002 '0002'X for 5555
	* Note: 5252 and 5251 Model 0001 not supported on WSCE controllers		
	Keyboard Option	Bit(16)	'0000'X - No keyboard attached '0002'X - Typewriter keyboard '0003'X - ASCII keyboard '0004'X - Data entry keyboard '0005'X - Data entry keyboard with inverted 10 key option (proof) '0008'X - International/ASCII data entry keyboard '0009'X - International ASCII data entry keyboard with inverted 10 key option (proof) '000A'X - World Trade typewriter keyboard '000B'X - International typewriter keyboard '000C'X - World trade data entry keyboard '000D'X - World trade data entry keyboard with inverted 10 key option (proof) On the ASUKA Display only three keyboard options are valid (all others invalid): '0000'X - No keyboard '0021'X - KANJI keyboard on KANJI Display '000A'X - Katakana Typewriter keyboard on KANJI Display
	Cable Address for this LU	Bit(16)	'0000'X - '0007'X

cable address represents the physical address of a twinax or coax. It is derived from the connector and OU# as follows:

Connector numbers 0 through 15 are attached to OU 30, connector numbers 16 through 31 are attached to OU 70, connector numbers 32 through 47 are attached to OU B0, and connector numbers 48 through 63 are attached to OU F0.

Cable addresses 0-7 correspond to connectors 0-7 on OU 30, 16-23 on OU 70, 32-39 on OU B0, and 48-55 on OU F0. Cable address 10-17 correspond to connectors 8-15 on OU 30, 24-31 on OU 70, 40-47 on OU B0, and 56-63 on OU F0. Cable addresses 10-17 require the installation of the second driver/receiver card.

Head (Station) Address	Bit(16)	'0000'X-'0006'X
This address is the physical address of a head (display or printer) on a daisy chained twinax (cable through feature). Allowable addresses are 0-6 for 5251. 0-5 for 5252. The values are selected via rocker switches on the devices. For a 5252 there is one set of switches for two displays. Set it to 0 for addresses 0-1, 2 for 2-3, and 4 for 4-5.		for 5251, 5291, 5292 or 5555 or 3180
		'0000'X-'0005'X
		for 5252

Reserved	Bit(16)	'0000'X
Katakana Keyboard attached	Bit(16)	'0000'X = Not attached '0001'X = attached

Translate Table Name	Char(8)	See table below
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For 5251,5252,5291 and 5292 devices:

Translate Table	Keyboard	Language	WSC Char Generator
#TPNDAGB	Data Entry	Austria/Germany	Basic
#TPNDAGI	Data Entry	Austria/Germany	International
#TPNDBLB	Data Entry	Belgium	Basic
#TPNDBLI	Data Entry	Belgium	International
#TPNDBRB	Data Entry	Brazil	Basic
#TPNDBRI	Data Entry	Brazil	International
#TPNDCAB	Data Entry	Canada (French)	Basic
#TPNDCAI	Data Entry	Canada (French)	International
#TPNDDMB	Data Entry	Denmark	Basic
#TPNDDMI	Data Entry	Denmark	International

#TPNDFAB	Data Entry	French (Azerty)	Basic
#TPNDFAI	Data Entry	French (Azerty)	International
#TPNDFNB	Data Entry	Finland	Basic
#TPNDFNI	Data Entry	Finland	International
#TPNDFQB	Data Entry	French (Qwerty)	Basic
#TPNDFQI	Data Entry	French (Qwerty)	International
#TPNDINB	Data Entry	International	Basic
#TPNDINI	Data Entry	International	International
#TPNDITB	Data Entry	Italian	Basic
#TPNDITI	Data Entry	Italian	International
#TPNDJEB	Data Entry	Japan (English)	Basic
#TPNDJEI	Data Entry	Japan (English)	International
#TPNDKAB	Data Entry	Japan (KATA)	Basic
#TPNDNWB	Data Entry	Norwegian	Basic
#TPNDNWI	Data Entry	Norwegian	International
#TPNDPRB	Data Entry	Portuguese	Basic
#TPNDPRI	Data Entry	Portuguese	International
#TPNDSPB	Data Entry	Spanish	Basic
#TPNDSPI	Data Entry	Spanish	International
#TPNDSSB	Data Entry	Spanish Speaking	Basic
#TPNDSSI	Data Entry	Spanish Speaking	International
#TPNDSWB	Data Entry	Swedish	Basic
#TPNDSWI	Data Entry	Swedish	International
#TPNDUKB	Data Entry	United Kingdom	Basic
#TPNDUKI	Data Entry	United Kingdom	International
#TPNDUSB	Data Entry	United States	Basic
#TPNDUSI	Data Entry	United States	International
#TPNTAGB	Typewriter	Austria/Germany	Basic
#TPNTAGI	Typewriter	Austria/Germany	International
#TPNTANI	Typewriter	Arabic	International (RPQ)
#TPNTBLB	Typewriter	Belgium	Basic
#TPNTBLI	Typewriter	Belgium	International
#TPNTBRB	Typewriter	Brazil	Basic
#TPNTBRI	Typewriter	Brazil	International
#TPNTCAB	Typewriter	Canada (French)	Basic
#TPNTCAI	Typewriter	Canada (French)	International
#TPNTDMB	Typewriter	Denmark	Basic
#TPNTDMI	Typewriter	Denmark	International
#TPNTFAB	Typewriter	French (Azerty)	Basic
#TPNTFAI	Typewriter	French (Azerty)	International
#TPNTFNB	Typewriter	Finland	Basic
#TPNTFNI	Typewriter	Finland	International
#TPNTFQB	Typewriter	French (Qwerty)	Basic
#TPNTFQI	Typewriter	French (Qwerty)	International
#TPNTGNI	Typewriter	Greek	International (RPQ)
#TPNTHNI	Typewriter	Hungary	International (RPQ)
#TPNTINB	Typewriter	International	Basic
#TPNTINI	Typewriter	International	International
#TPNTITB	Typewriter	Italian	Basic
#TPNTITI	Typewriter	Italian	International
#TPNTJEB	Typewriter	Japan (English)	Basic
#TPNTJEI	Typewriter	Japan (English)	International
#TPNTKAB	Typewriter	Japan (KATA)	Basic (* See note.)
#TPNTNWB	Typewriter	Norwegian	Basic
#TPNTNWI	Typewriter	Norwegian	International
#TPNTPNI	Typewriter	Poland	International (RPQ)
#TPNTPRB	Typewriter	Portuguese	Basic
#TPNTPRI	Typewriter	Portuguese	International
#TPNTRNI	Typewriter	Romania	International (RPQ)
#TPNTSFB	Typewriter	Swiss/French	Basic
#TPNTSGB	Typewriter	Swiss/German	Basic
#TPNTSPB	Typewriter	Spanish	Basic
#TPNTSPI	Typewriter	Spanish	International
#TPNTSSB	Typewriter	Spanish Speaking	Basic
#TPNTSSI	Typewriter	Spanish Speaking	International

#TPNTSWB	Typewriter	Swedish	Basic
#TPNTSWI	Typewriter	Swedish	International
#TPNTTNI	Typewriter	Turkey	International (RPQ)
#TPNTUAB	Typewriter	United States ASCII	Basic
#TPNTUAI	Typewriter	United States ASCII	International
#TPNTUKB	Typewriter	United Kingdom	Basic
#TPNTUKI	Typewriter	United Kingdom	International
#TPNTUSB	Typewriter	United States	Basic
#TPNTUSI	Typewriter	United States	International
#TPNTYNI	Typewriter	Yugoslavia	International (RPQ)
#TPNIKKB	Ideographic	Japan	

For the 5555 display device:

Translate Table	Keyboard	Language	WSC Char Generator
#TPNTKAB	Typewriter	Japan (KATA)	Basic
#TPNIKKB	Ideographic	Japan	

For the 3180 display device:

Translate Table	Keyboard	Language	WSC Char Generator
#TPNECAB	Data Entry	Canada (French)	Basic
#TPNECAI	Data Entry	Canada (French)	International
#TPNEKAB	Data Entry	Japan (KATA)	Basic
#TPNESSB	Data Entry	Spanish Speaking	Basic
#TPNESSI	Data Entry	Spanish Speaking	International
#TPNEUSB	Data Entry	United States	Basic
#TPNEUSI	Data Entry	United States	International
#TPNPARI	Typewriter	Arabic	International
#TPNPAXI	Typewriter	Arabic Cursive	International
#TPNPFSB	Typewriter	Finland/Sweden	Basic
#TPNPFSI	Typewriter	Finland/Sweden	International
#TPNPGKI	Typewriter	Greek	International
#TPNPBBI	Typewriter	Hebrew	International
#TPNPBGI	Typewriter	Hungarian	International
#TPNPICI	Typewriter	Icelandic	International
#TPNPPOI	Typewriter	Polish	International
#TPNPRMI	Typewriter	Romanian	International
#TPNPFSI	Typewriter	Swiss/French	International
#TPNPSSI	Typewriter	Swiss/German	International
#TPNPTHI	Typewriter	Thai	International
#TPNPTKI	Typewriter	Turkish	International
#TPNPYGI	Typewriter	Yugoslavian	International
#TPNPAGB	Typewriter	Austria/Germany	Basic
#TPNPAGI	Typewriter	Austria/Germany	International
#TPNPBLB	Typewriter	Belgium	Basic
#TPNPBLI	Typewriter	Belgium	International
#TPNPCAB	Typewriter	Canada (French)	Basic
#TPNPCAI	Typewriter	Canada (French)	International
#TPNPDMI	Typewriter	Denmark	International
#TPNPFAB	Typewriter	French (Azerty)	Basic
#TPNPFBI	Typewriter	French (Azerty)	International
#TPNPINI	Typewriter	International	International
#TPNPITB	Typewriter	Italian	Basic
#TPNPKAB	Typewriter	Japan (KATA)	Basic
#TPNPNB	Typewriter	Norwegian	Basic
#TPNPNI	Typewriter	Norwegian	International
#TPNPPIB	Typewriter	Portuguese	Basic

#TPNPPRI	Typewriter	Portuguese	International
#TPNPSFB	Typewriter	Swiss/French	Basic
#TPNPSGB	Typewriter	Swiss/German	Basic
#TPNPSPB	Typewriter	Spanish	Basic
#TPNPSPPI	Typewriter	Spanish	International
#TPNPSSB	Typewriter	Spanish Speaking	Basic
#TPNPUKB	Typewriter	United Kingdom	Basic
#TPNPUKI	Typewriter	United Kingdom	International
#TPNPUSB	Typewriter	United States	Basic
#TPNPUSI	Typewriter	United States	International

Retry Value Sets	N/A	Bin(2)	'0000'X
Error Thres- hold Sets	N/A	Bin(2)	'0000'X
Device Speci- fic Contents	Length of Device Specific contents	Bin(2)	'0004'X for all device types if attached to WSC controller '0014'X if attached to WSC-E controller
	Length of Device Specific contents modifiable and materializable area	Bin(2)	'0004'X for WSC '0014'X for WSC-E
Device Speci- fic Area	Reserved	Bit(16)	'0000'X
	Device Format Table Length (use as small a value as possible since this uses extended data store shared with other devices on this WSC and could therefore limit the number of devices on this WSC - see section 5.4.5.4)	Bit(16)	'0001'X - 256 bytes '0002'X - 512 bytes '0003'X - 768 bytes
			For WSC-E only, these additional values are supported: '0004'X - 1024 bytes '0005'X - 1280 bytes '0006'X - 1536 bytes '0007'X - 1792 bytes
	Extension Character Object Space Pointer ('5555' only) See section 5.4.5.5	Char(16)	Address of IGC Character Table (WSC-E only). Binary zero if object does not exist or not an IGC device or on WSC controller.

5.4.5.3 LUD Template Data for the 5256, 5224, 5225, 5219, 5553 Printers

Field Name	Description	Length	Data
LUD Type	Logical unit that is attached to a CD	Char(2)	'10'C
Device Type	The devices IBM product	Char(4)	'5256'C

	number		or '5224'C or '5225'C or '5219'C or '5553'C
Model Number	The devices model number	Char(4)	For 5256: '0001' 40 CPS '0002' 80 CPS '0003' 120 CPS For 5224: '0001' 137 LPM '0002' 240 LPM '0012' 55/440 CPS (IGC-PRAWN) For 5225: '0001' 280 LPM '0002' 400 LPM '0003' 490 LPM '0004' 560 LPM '0011' 85/300 LPM (IGC-SKATE) '0012' 140/475 LPM (IGC-SKATE) For 5219: '0001' 40 CPS, max line width 13.2 inches '0002' 60 CPS, max line width 13.2 inches For 5553: ' B01' 40/120 CPS (IGC)
Physical Address	Logical units complete network address	Char(8)	
* Reserved	These two bytes always zero	Bin(2)	'0000'X
* LU Address (DAF)	Destination address of the printer or display (LSID) Note: Best performance is obtained when LSIDs are assigned contiguously starting with LSID '0000'X.	Bin(2)	'0000'X - '0013'X if attached to a WSC controller '0000'X - '001F'X if attached to a WSCE controller
* Station Line Address	N/A	Bin(2)	'0000'X
* OU# Same # as in CD	OU# of WSC this LU attaches to	Bin(2)	'0030'X, '0070'X '00B0'X or '00F0'X
Power Control	N/A	Char(2)	'0000'X
Session Information		Char(20)	
* Inbound Pacing	Defines # transmissions before a pacing response is needed. Pacing printer to host. Always binary zero: No pacing in this direction	Bin(2)	'0000'X
* Outbound Pacing	Defines #transmissions before a pacing response is needed. Pacing host to printer. Note: This field cannot be less than 2 or greater than the number of print buffers	Bin(2)	'0002'X - '0007'X

specified in the Device Specific area of this LUD			
* RU Buffer Size	Maximum Request Unit Length	Bin(2)	'0100'X=256 bytes
* ACTLU	Indicates that the printer needs an ACTLU to be activated	Char(1)	'01'X
* ACTLU Parameters	SNA ACTLU data for the printer	Char(3)	'000101'X
* ACTLU Response	Return area for ACTLU Response	Char(8)	All binary zeros
Load/Dump Indicator	N/A	Char(4)	All Binary Zeros
Specific Characteristics	Length of specific characteristics area Device descriptor	Bin(2)	'0014'X=20 bytes
		Bit(16)	For 5256: '0020'X For 5224 Model 0001 or 0002: '0024'X For 5224 Model 0012: '0026'X For 5225 Models 0001-0004: '0028'X For 5225 Models 0011, 0012: '002A'X For 5219 '002D'X For 5553: '002E'X
	Keyboard Option	Bit(16)	Always '0000'X
	Cable address for this LU cable address represents the physical address of a twinax or coax. It is derived from the connector and OU# as follows: Connector numbers 0 through 15 are attached to OU 30, connector numbers 16 through 31 are attached to OU 70, connector numbers 32 through 47 are attached to OU B0, and connector numbers 48 through 63 are attached to OU F0. Cable addresses 0-7 correspond to connectors 0-7 on OU 30, 16-23 on OU 70, 32-39 on OU B0, and 48-55 on OU F0. Cable address 10-17 correspond to connectors 8-15 on OU 30 24-31 on OU 70, 40-47 on OU B0, and 56-63 on OU F0. Cable address 10-17 require the installation of the second driver/receiver card.	Bit(16)	'0000'X-'0007'X or '0010'X-'0017'X if attached to a WSC controller '0000'X-'0007'X only, if attached to a WSCE controller
	Head (Station) Address This address is the physi-	Bit(16)	'0000'X-'0006'X

cal address of a head
(display or printer) on
a daisy chained twinax
(cable through feature).
Allowable addresses are
0-6.

The values (0-6) are
selected via Rocker
switches on the
device.

	Reserved	Bit(16)	'0000'X
	Katakana Keyboard Attached	Bit(16)	Always '0000'X
	Translate Table Name	Char(8)	Always binary zeros
Retry Value Sets	N/A	Bin(2)	'0000'X
Error Thresh- hold Sets	N/A	Bin(2)	'0000'X
Device Speci- fic Contents	Length of Device Specific area	Bin(2)	'0004'X if attached to WSC controller
	Length of Device Specific modifiable area	Bin(2)	'0014'X if attached to WSCE controller '0004'X if attached to WSC controller '0014'X if attached to WSCE controller
Device Speci- fic Area	Reserved	Bit(16)	'0000'X
	Number of 256 byte printer buffers Note: This field must be equal to or greater than the outbound pacing.	Bit(16)	'0003'X-'0007'X
	Extension Character Object Space Pointer (IGC devices only) See section 5.4.5.5	Char(16)	Address of IGC Character Table if attached to WSCE Controller object. If not IGC device, or if object deleted (cannot be Resolved), or if attached to WSC controller this field must be set to binary zeros.

5.4.5.4 Extended Data Store Considerations

The extended data store size indicated in the MCR, restricts the number of devices, translate tables, format tables, and print buffers that can be allocated on one controller. For WSC controllers, the extended data store is featurable in 8K increments to a maximum of 32K bytes. For WSCE controllers, the extended data store is 48K bytes. The following formula indicates the amount of storage required (in K bytes) for any given work station configuration:

SR = Storage Required (in kilobytes)
FMTL = Device Format Table Length
(in Device Specific Area of section 5.4.5.2)
PBL = Number of 256 byte printer buffers
(in Device Specific Area of section 5.4.5.3)

TT = Total number of unique non-ideographic/non-Katakana translate tables
TTK = Total number of unique Katakana translate tables (#TPNDKAB or #TPNTKAB)
TTI = Total number of unique adeographic translate tables (#TPNIKKB-valid only on WSCE controllers)
TKAB = Total number of unique typewriter Katakana translate tables (#TPNTKAB)

For WSC Controllers:

$$SR = 2.75 + .5(TT) + 1.0(TTK) + D1 + D2 + DN + P1 + P2 + \dots + PN$$

For WSCE Controllers:

$$SR = 4.0 + .5(TT) + 1.0 + (TTK) + 8.5(TTI) - (TTI)(TKAB) + D1 + D2 + \dots + DN + P1 + P2 + \dots + PN$$

Where $D1 = .25 + .25(FMTL)$ for the 1st DISPLAY attached to this controller

$D2 = .25 + .25(FMTL)$ for the 2nd DISPLAY, etc.

$P1 = .25 + .25(PBL)$ for the 1st printer attached to this controller

$P2 = .25 + .25(PBL)$ for the 2nd printer, etc.

Configuration example:

Devices attached to WSCE controller:

1 ideographic display (D1) with Japanese ideographic keyboard (FMTL=3)

1 ideographic display (D2) with Katakana typewriter keyboard (FMTL=2)

2 Katakana display (D3-D4) with Katakana data entry keyboards (FMTL=3)

2 Printers (P1-P2) with PBL=4

Therefore:

TT=0 because only ideographic or katakana translate tables are used

TTK=2 (1 for D2 and 1 for D3 and D4)

TTI=1 (for D1)

TKAB=1 (for D2)

$D1 = .25 + .25(3) = 1.0$

$D2 = .25 + .25(2) = 0.75$

$D3 = .25 + .25(3) = 1.0$

$D4 = .25 + .25(3) = 1.0$

$P1 = .25 + .25(4) = 1.25$

$P2 = .25 + .25(4) = 1.25$

The storage requirement is therefore:

$SR = 4.0 + .5(0) + 1.0(2) + 8.5(1) - (1)(1) + 1.0 + 0.75 + 1.0 + 1.0 + 1.25$
 $1.25 = 19.75$ K bytes

Since this does not exceed 48K, this configuration is safe.

If the computed extended data storage required exceeds the amount indicated in the MCR, error code '0402'X will be reported and the vary on CD will fail. See error code '0402'X in Table 1.

Number of Input Fields:

The following formula can be used to determine the maximum number of input fields that can be defined for a given display screen:

$$\#FLDS = FMTL(256) - 2(\#FCW) - \#MSR$$

6

where $\#FLDS$ = Number of input fields

$\#FCW$ = Number of ideographic, self check, light pen, or magnetic stripe OI fields on the display screen (i.e., $\#$ of FCSs specified)

FMTL = Device Format Table Length (In Device Specific Area of Section 5.4.5.2)

$\#MSR$ = 3 + length (in bytes) of the longest magnetic stripe record to be read

For example, if FMTL=3, and no FCWs or MSR input is specified:

$$\#FLDS = (3(256) - 2(0) - 0)/6 = 768/6 = 128$$

If FMTL=3, and 5 FCWs are specified on a display screen, and a maximum 25-byte magnetic stripe data record is to be read:

$$\begin{aligned} \#FLDS &= \frac{3(256) - 2(5) - (3+25)}{6} \\ &= \frac{768 - 10 - 28}{6} = \frac{730}{6} = 121.6 \end{aligned}$$

Note that for WSCE, although the value of FMTL may range from 1 through 7, the average value for all displays should not exceed 3 or else the storage requirement for 32 workstations will exceed the 48K byte extended data store size limit. Therefore, the controller provides the capability to trade off limitations on quantity of input fields versus quantity of attached devices.

5.4.5.5 Extension Character Table

The Extension Character Object Space pointer will print to an IGC Character Table which defines ideographic characters. Two formats as defined, one for 18 X 18 dot matrix size characters (table name QIGC1818), and one for 24 X 24 dot matrix size characters (table name QIGC2424).

This table is maintained by the Character Generation Utility (CGU) but used by the IOM to extract IGC character definitions.

QIGC1818

(for 5224 M-12 and 5225 M-11,12 Printers)

HEADER	'F1F8F1F8' CHAR(4) (IDENTIFY QIGC1818)	4 bytes Reserved for use by CGU
	2 bytes (Reserved for use by CGU)	2 bytes (Uppermost IGC code of user-defined characters)
	50 bytes (Reserved for use by CGU)	
17 SPECIAL CHARACTERS	X'FE41' to X'FE51'	
	X'5641'	
IBM SUPPLIED	.	.
	.	.
	.	.
	.	.
	X'687F'	
	X'6880' --> X'68FE' (SET TO X'00')	
USER AREA (Expandable up to X'7FFE' but initially has zero characters defined)	X'6941'	
	.	.
	.	.
	.	.
	.	.
	.	.
	X'7FFE'	
	IGC Code (2 bytes)	Dot Matrix for 18 X 18 (54 bytes)

QIGC2424

(for 5555 Display and 5553 Printer)

HEADER	'F2F4F2F4' CHAR(4) (IDENTIFY QIGC2424)	4 bytes Reserved for use by CGU
	2 bytes (Reserved for use by CGU)	2 bytes (Uppermost IGC code of user-defined characters)
	50 bytes (Reserved for use by CGU)	
17 SPECIAL CHARACTERS	X'FE41' to X'FE51'	
	X'5641'	
IBM SUPPLIED	.	.
	.	.
	.	.
	.	.

USER
AREA
(Expandable
up to
X'7FFE' but
initially
has zero
characters
defined)

X'687F'	
X'6880'	--> X'68FE' (SET TO X'00')
X'6941'	
.	.
.	.
.	.
.	.
.	.
X'7FFE'	

IGC Code
(2 bytes)

Dot Matrix for 24 X 24
(72 bytes)

Notes:

- Bit patterns for characters are horizontal slices.
- Point values X'00'-X'40' and X'FF' are invalid and do not occupy space; eg. the next character after X'56FE' is X'5741'.

Record Format:

QIGC1818

QIGC2424

Bytes 1-2 = IBM Ideographic code

Bytes 1-2 = IBM Ideographic code

Bytes 3-5 = Bit Pattern Row 1

Bytes 3-5 = Bit Pattern Row 1

Bytes 6-8 = Bit Pattern Row 2

Bytes 6-8 = Bit Pattern Row 2

Byte 54-56 = Bit Pattern Row 18

Byte 70-72 = Bit Pattern Row 24

5.5 COMMUNICATIONS DEVICE MANAGEMENT--BSC

This section describes the programming considerations and specific device support requirements for BSC communications Source/Sink devices. General information regarding the commands and objects can be found in the instruction writeups.

The device management operates on behalf of a controller (station) or CPU and the logical unit (device) attached to the CPU. The device management performs BSC functions necessary to complete a REQIO instruction (ie, contention resolution, session control, link ERP, link protocol, and protocol error recovery).

5.5.1 COMMUNICATIONS DEVICES SUPPORTED

The following devices and CPU-applications are supported by System/38 BSC:

3741	3750 World Trade only
5110	3751 World Trade only
5120	FAIRWAY
5230	
5260	
5280	
OS/6	
6670	
5520	
6580	

S/38 RPG III, COBOL
 S/3 MLMP *
 S/3 CCP *
 S/3 RPG II
 S/32 RPG II
 S/34 RPG II, SSP-ICF/BSCCL
 SERIES/1 RPS, EDX *
 370 BTAM DOS/VS *
 370 BTAM/TCAM OS/VS *

* These systems are also capable of providing BSC Multipoint Control support to connect to System/38 BSC Multipoint Tributary support.

5.5.2 BSC COMMUNICATIONS DEVICE LOGICAL UNIT DESCRIPTION (LUD)

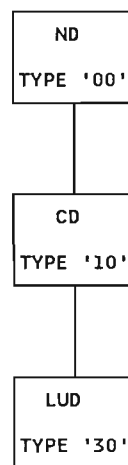
All BSC communications devices require a Logical Unit Description (LUD) object to be created for their support. These LUDs are of a LUD type '30' for which a Network Description (ND) object and Controller Description (CD) object are required for the LUD's attachment to System/38. All information necessary to create LUDs for each specific

communications device will be supplied in the subsequent sections. That information which is common to all LUDs, such as name, creation options, forward pointers, type definitions, associated space, and etc, is defined by the Source/Sink architecture.

5.5.3 COMMUNICATIONS DEVICE ATTACHMENT (ND AND CD)

Two communications object configuration exists for attachment of BSC communications LUD objects to System/38 (see Figure 5.5.3). The LUD type requires the creation of both ND and CD objects. The specific data required in the ND, CD, and LUD for a given line type is discussed in subsequent sections. BSC has two mutually exclusive configurations. One, point-to-point connections where only one LUD and one CD are allowed to be attached to each ND at any point in time. Two, Multi point tributary connections where up to 32 LUD's may be attached to each CD, and one CD is attached to an ND at any one point in time.

POINT TO POINT



MULTI-POINT TRIB

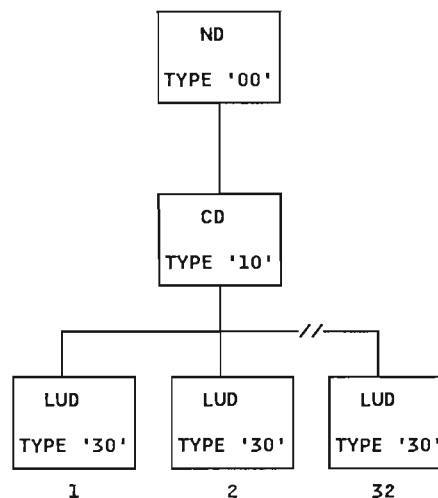


Figure 5.5.3 Communications Object Configuration--BSC

5.5.4 PROGRAMMING CONSIDERATIONS

Communication with a CPU or device is accomplished through BSC data paths. A BSC path is activated when a REQIO (Bid) is executed. To manage these BSC paths, the device management supports the following MI commands.

MODND: Vary On/Off/Switched Enable/Switched Disable
Manual Answer/Abandon Call/Start Data
CD Eligibility List/Selectable Modes
Continue/Cancel

MODCD: Vary On/Off
Dial/Abandon Connection
ND Candidate List
Dial Digits field
Unit Specific Contents field (XID list)
Continue/Cancel

MODLUD: Vary On/Off
Activate/Deactivate
Reset
Suspend
Quiesce
Continue/Cancel

REQIO: Functions - Normal
Control - Normal
Continue

Prior to using any of these commands, the user must create the network describing the line-ND, the controller-CD, and the device(s)-LUD. This is done by using the following MI support code instructions:

CRTND - Create Network Description
CRTCD - Create Controller Description
CRTLUD - Create Logical Unit Description

See appropriate sections for the template data needed to create the objects for the line(ND), station(CD), and device(LUD).

5.5.4.1 MI Commands

MODIFY ND

MODND (Vary On/Off)

These instructions are used to activate or deactivate the BSC communications line appearance.

MODND (Switched Enable/Disable)

These instructions are used to allow or disallow use of the switched communications line after it has been varied on. When going into switched enable mode for answer operations, the Eligibility List of this ND must contain at least one valid CD object. Note: Not used for multipoint protocol.

MODND (Manual Answer/Abandon Call)

These instructions are used to synchronize the hardware adapter signals with operator actions for completing or discontinuing a switched manual answer connection. Specifically, these commands indicate that the operator has established the connection and causes the machine to initialize the line. Note: Not used for multipoint protocol.

MODND (Start Data)

This instruction indicates that the operator has manually placed the modem in Data Mode, and the line is now ready for Data Communications. Note: Not used for multipoint protocol.

MODND (CD Eligibility List)

This instruction is used to specify which switched CD's are to be searched for XID match on switched answer mode operations. When an incoming (answer) switched connection occurs this list will be searched in order and the first CD in vary on pending state with matching XID conditions will be selected. Note: Not used for multipoint protocol.

MODND (Cancel)

This instruction is used to suspend the reconnection and reuse of the communication line.

MODND (Continue)

This instruction is used to enable (allow) the reuse of the line after an unrecoverable error has occurred.

MODIFY CD

MODCD (Vary On/Off)

This instruction is used to perform preliminary setup for the communication path to the physical unit in the CPU or station represented by the CD.

MODCD (Dial/Abandon Connection)

These instructions are used to allow a station on a switched communication link to be dialed manually or to be disconnected. The machine selects an available ND (line) to be used from the candidate list. Note: Not used for multipoint protocol.

MODCD (Selected Modes)

This instruction is used to change the delay time for this program and delay time for this device. For CD type 'BSC' this command can select SNBU and MTAM. MTAM operations are described separately in Section 5.6 of this document.

MODCD (Dial Digits)

This instruction is used to change the telephone number in the CD which is to be used to make the switched connection on the MODCD (dial out) operation. Since the BSC CD may potentially represent several different far end stations which are reached through different numbers, this field can be modified any time prior to the dial out operation. Note: Not used for multipoint protocol.

MODCD (ND Candidate List)

This instruction is used to specify which switched lines (ND's) are to be used to establish a dial out connection. When a dial operation for this CD is requested, the list is searched in order and the first ND which is in the proper mode and not already in use will be selected. Note: Not used for multipoint protocol.

MODCD (Unit Specific Contents - XID List)

This instruction can be used to change the XID entries which are used by the machine to match against incoming XID's from the remote stations. Since the BSC CD can represent many different stations, the remote XIDs can be modified to represent a different station or set of stations.

It is recommended that this command be used only prior to raising the state of the CD to vary on pending state. Although the general architecture allows modification at any point, doing so in BSC would be meaningless based on the defined contents of this field and unpredictable results may occur. Note: Not used for multipoint protocol.

MODCD (Cancel)

This instruction is used to suspend reconnection and reuse of the controller.

MODCD (Continue)

This instruction is used to enable the reuse of the controller and to request that contact be established after an unrecoverable error has occurred.

MODIFY LUD**MODLUD (Vary On/Off)**

These instructions perform preliminary set up for the BSC data path.

MODLUD (Activate)

This instruction is used to prepare the communication path from the System/38 LU to the CPU or station's LU. MODLUD (activate) is also used to activate the BSC path when it is in reset, suspended, or quiesced state.

MODLUD (Deactivate)

This instruction is used to deactivate the communications path from the system to the CPU or station.

MODLUD (Reset) & (Quiesce)

These instructions cause all REQIOs pending for this LUD to be flushed back to the user's return queue, in an orderly fashion, with a feedback status indicating the flushed condition. The number of request descriptors processed will also be set in the feedback record. This command also places the path in an inactive state, which can be reactivated with a MODLUD (activate) command. All available unreceived data is relinquished by this instruction. This command also causes a BSC abort or forward abort to be sent to the remote device if required by link protocol.

MODLUD (Suspend)

This instruction causes REQIO processing to be suspended at the next REQIO boundary for REQIO's on this LUD. A MODLUD (activate) command will cause processing to restart. A MODLUD (deactivate) command will cause an implicit reset operation which will flush all unprocessed Request IOs for this LUD prior to deactivation.

MODLUD (Cancel)

This instruction is used to suspend the device after an unrecoverable error.

MODLUD (Continue)

This instruction is used to enable (allow) the reuse of the device after an unrecoverable error has occurred.

5.5.4.2 REQIO Instruction**5.5.4.2.1 ASYNCHRONOUS REQUEST I/O**

This command is used for three purposes. First, it is used to perform I/O on the BSC data path. Second, it is used to cause a line bid to occur on the data link for a PT-PT line or Poll/Select eligibility on a Tributary connection. Third, the REQIO (continue) is used to return the logical unit to active path state after it has encountered a terminating error.

Refer to the Request I/O instruction for details on the REQIO command and its Source/Sink Request (SSR) object.

BSC DEVICE MANAGEMENT S/S REQUEST (SSR) GENERAL

The SSR Function Field bits have the following meanings for BSC device management:

Bits 0-3 - The only valid value is X'8' - normal path.

Bits 4-7 - These bits define the content and type of I/O being requested. The valid values and their meanings are:

- Bit 4 - Indicates that this REQIO contains a BID RD as the only RD.
- Bit 5 - Indicates that an EOT is to be sent on the link after other processing is completed for this REQIO.
- Bit 6 - Indicates that this REQIO contains Send RD(s)
- Bit 7 - Indicates that this REQIO contains a receive RD.

The following programming rules apply to bits 4-7.

1. For REQIO Continue, bits 4-7 must all be zero.
2. Bit 5 may be on only if bit 6 is on. EOT may be transmitted only after transmitting data.
3. The sequence of operations specified by a sequence of REQIOs must adhere to BSC link protocol requirements specified by CP-AR-00658-RAL.
4. A bid REQIO must be the first REQIO after activating a session.
5. A bid REQIO must be the first REQIO after an EOT passes across the link on a per session basis.
6. System/38 BSC supports only batch-type data transfer. That is, for any line bid to EOT time, all data must flow in one direction only. Conversational link protocol is not supported.

BSC DEVICE MANAGEMENT REQUEST DESCRIPTOR

This request descriptor (RD) is used for BSC communications devices. The RD contains information which details what I/O operations to perform. The RD also provides for the length and location of the data in the source/sink data area (SSD). The fields in the RD are described below:

REQUEST I/O RD FORMAT FOR BSC

Request Descriptor	Char(16)
- Command Field	Char(2)
-- Bid for line	Bit 0
-- Send Data	Bit 1
-- Send RVI	Bit 2
-- Reserved (binary zero)	Bit 3
-- RD Contains start delimiter (SOH or STX or DLESTX)	Bit 4
-- RD ends with ITB delimiter	Bit 5
-- RD contains end delimiter (ETB or ETX)	Bit 6
-- Receive Data	Bit 7
-- Reserved (see synchronous Request I/O)	Bit 8
-- Reserved (binary zero)	Bits 9-15
- First Block Received Length	Bin(2)
- Data Area Length--Send or Receive	Bin(4)
- Receive Data Actual Length (Total	Bin(4)
- Data Offset	Bin(4)

BSC RD COMMAND BIT DESCRIPTIONS

Bid for Line--When this bit is '1', the machine bids for the communication line. The direction of the bid is determined by the send data bit (bit 1) or receive data bit (bit 7) being on. Only one of these two bits may be on and all other command bits must be off.

Send Data--When this bit is '1', the machine will transmit data across the communication link. The machine will automatically handle link level ERP including WACK, TTD, and RVI. One or more send data RDs (max 255) may be used in one REQIO.

Send RVI--When this bit is '1', an RVI is sent instead of a positive acknowledgement sequence. This bit is used in conjunction with the receive function. Send RVI may be set on more than once during data state. The machine keeps track of its occurrence and only transmits RVI at most once every other text block.

RD contains start delimiter--This bit indicates that the data associated with the RD starts with one of the following BSC start sequences:

SOH - STX - DLESTX

RD Ends with ITB delimiter--This bit indicates that the data associated with the RD ends with an ITB.

RD Contains end delimiter--This bit indicates that the data associated with the RD ends with an ETB or ETX. The RD in which this bit is on can only be the last RD in the REQIO.

Receive Data--This bit indicates that a receive operation is to be performed. An acknowledgement will be sent following the receipt of ETB or ETX. This receive operation

will only end when data is received, a MODLUD (reset) is executed, or after the Receive Timeout time period multiplied by the retry value has passed with no valid data received.

First Block Received Length--This field is the length of the first block received. NOTE - only when ITB's are received will this field be less than the Receive Data Actual Length Field.

Data Length-Send or Receive--This field is used to specify the available buffer lengths in the SSD as follows:

- 1 SEND DATA--This field specifies the actual length of the data to be sent by this RD.
- 2 RECEIVE DATA--This field specifies the actual length available to the machine for receiving data and status for this RD.

Note: The BSC IOM input and output buffers are each 16,384 bytes long.

Receive Data Actual Length--This field is used by the machine to return the actual length of data and status received during a receive operation. The length of the first two byte status field will not be included in this length.

Data Offset--This field contains the displacement, in bytes, to the beginning of the data relative to the SSD space pointer supplied in the SSR of the REQIO instruction.

The data offset value should adhere to the following rules:

- 1 For receive RDs--points to a boundary (512) consistent with block size and the size of the SSD (must not point past the allocated end of the space).
- 2 The first send RD in a REQIO should have an offset pointing to a boundary (8) location or the machine will move the data to a properly aligned buffer. The first RD following any RD which specifies ITB ending should also have an offset pointing to a boundary (8) location.
- 3 The offset and length must be within the space allocation.
- 4 For all other send RDs--the offset field should point to the next contiguous byte of storage past the end of the previous RDs data.

NOTE: It is strongly recommended that the offsets for RDs point to data on the correct boundaries and the data does not cross a 64K boundary. These alignments are required by the machines operational units. If the alignment is not followed a significant performance degradation will occur.

Length example - Send

RD1 - send data	RD2 - send data
start char	start char
ITB char	end char
offset - 0	offset - 16
len - 10	len - 10

SSD:

S	I	S	E
T A B C D E F G H T	...	T I J K L M N O P T	
X	B	X	B

Length example - Receive

RD1 - receive data
Data Area length - 100
Len of first received block - 10
Total record len - 22

SSD:

S	I	S	E
T A B C D E F G H T	000C	T I J K L M N O P T	
X	B	X	B

SOURCE/SINK DATA CONTENTS--NORMAL SEND REQIO

The SSD for BSC Device Management RDs contains data as defined by the RDs. One data block may be defined by one or many RDs. Data to be transmitted must contain link control characters as defined in internal BSC spec CP-AR-00658-RAL section 3.8.1. The data must be correctly described by the RDs. When receiving, each data block except the first is preceded by a two-byte length count giving the size of the immediately following block of data. The SSD is accessed by the machine in 8 byte increments so on receive any unused increment may contain unpredictable data.

NOTES ON REQIO

- 1 Only one block of text can be transmitted or received per REQIO.

5.5.4.2.2 SYNCHRONOUS REQUEST I/O

The synchronous REQIO for the BSC support was the same SSR template and field definitions as the asynchronous REQIO. Specific values are as follows:

- Request I/O Timeout	Specify a normal value
- Response Queue Pointer	None required
- Control Field	Specify '20'X
- Key Fields (all)	None required
- RD Count	Specify '01'X

- RD	Char (16)
--Command Field	Char(2)

Bits 0-7 reserved

Bit 8 - CANCEL INVITE

This command causes all Request I/Os for this session up to the next BID Request to be flushed back to their appropriate FBR queues with error summary field indicating either partially processed or unprocessed as a result of this synchronous CANCEL INVITE operation. This command does not cause any other state

changes for the session and will not discard any incoming data. If issued at any point in time which is not appropriate for this operation, this request will be terminated with an Invalid Object State exception.

- Bits 9-15 reserved
- Bytes 2-15 Normal usage
- All other fields - normal usage

5.5.4.3 Feedback Record and Error Recovery Procedures

The format of the Feedback Record is as follows:

Bytes 00-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Timestamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for description of the request address and request ID fields.

The error summary field defines the status of the REQIO as generally defined in the REQIO instruction description. The specific values possible for BSC are itemized in Table 1 of this section.

The RD number is the index of the last RD processed, or the RD in error, if an error is indicated.

The RIU segment count is unused by BSC and is set to binary zeros.

The device dependent area is binary zeros unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction). If the device dependent data is present, the fields have the following meaning:

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered. The possible values are shown in Table 1 and further information is present in System 38 Hardware Functional Specification.

The time stamp and OU# are the same values present in the hardware error log entry.

Table 1 lists the error summary, device dependent error codes, the hardware error log codes, what caused the problem, and the recommended recovery actions.

Note: For line or station failures on a multipoint line each session with no unretrieved RECEIVE data on the failing CD will have one REQIO (if outstanding at the time of failure or issued after the failure) returned with the failing error code.

Sessions that have RECEIVE DATA buffered at the time of the failure will return the data on the first REQIO received after the failure. A subsequent REQIO (second or third - depending on the circumstance) received after the failure will receive the failing error code.

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS	RD BITS
					4567	0123 4567
X'0000'	N/A	N/A	No error condition		XXXX	XXX. XXXX
X'0008'	N/A	N/A	Req I/O cont completion	N/A	N/A	N/A
X'0016'	N/A	N/A	Normal EOT received	Issue a REQIO with a bid seq RD or deactivate the session	...X	X
X'0044'	N/A	N/A	S/S data area too small. RCVD data was truncated	Use a larger SSD to eliminate truncation Data has been lost.	...X	X
X'400A'	N/A	N/A	Unprocessed due to a synchronous REQIO (cancel invite) being issued.	Processing continues at the next Request I/O instruction which indicates BID request (transmit or receive).	XXXX	XXX. XXXX
X'5001'	N/A	N/A	RVI received	End transmitting at the earliest opportunity--REQIO with write EOT then start receiving data--REQIO bid receive	..X.	.X.. XXX.
X'5002'	N/A	N/A	Contention loser on PT-PT protocol or MP Trib select rcv'd when REQIO bid xmit pending for selected session.	This machine is specified as a slave device and has lost the contention race. Issue a receive REQIO (Bid) and receive REQIOs to accept the received data.	X.X.	XX..
X'5003'	N/A	N/A	Protocol violation in user request 1. conversational rply attempt	Only issue REQIO (snd) or REQIO (snd) between REQIO (bid) and EOF	XXXX	XXX. XXXX
X'5004'	N/A	N/A	RFT processed	Reissue REQIO (bid, rcv)	...X	X
X'5016'	N/A	N/A	Previous EOT received	Issue REQIO (bid) or deactivate session	...X	X
X'C009'	N/A	N/A	Part proc'd req term due to reset session or quiesce	Continue cleanup	XXXX	XXX. XXXX
X'C00A'	N/A	N/A	Unprocessed due to reset session or quiesce	Continue cleanup	XXXX	XXX. XXXX
X'C00B'	N/A	N/A	IOM Partial Damage	Vary off the CD and LUD to clear this condition. A partial damage event (CD and/or LUD) has also been signaled.	XXXX	XXX. XXXX

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS 4567	RD BITS 0123 4567
X'C016'			EOF notification pending when a line or station failure occurred.	Deactivate session. This error code will only occur when the BSC IOM is holding an EOF notification and a line or station failure has occurred. The next REQIO issued by the session with EOF pending will be returned with C016. This REQIO has not been validated in any way. All REQIOs, if any following this REQIO will be returned with line or station failure. The line or station failure event will be signaled prior to receiving this error.	XXXX	XXX. XXXX
X'C040'	N/A	N/A	Invalid ASCII during send	Remove any nonASCII data	..X.	.X.. XXX.
X'C041'	N/A	N/A	SSD Destroyed (Not supported until Feature Group 4)	Provide a correct SSD, perform any higher level recovery which is necessary since data may have been lost, then, reissue REQIO, and issue a REQIO continue.	..XX	.XX. XXXX
X'C042'	N/A	N/A	Data not framed correctly. The send data does not agree with the send RDS	User program error	..X.	.X.. XXX.
X'C044'	N/A	N/A	Invalid RD data offset value	User program error	..X.	.X.. XXX.
X'C084'	N/A	N/A	Null SSD PTR	SSD PTR must be a valid data PTR for this Request I/O	..XX	.X.. ...X
X'C085'	N/A	N/A	Invalid Function Field	Function field must follow rules stated in MI Vol IV, Section 5.5.4.2	XXXX	N/A
X'D016'	N/A	N/A	Normal Disconnect received	Deactivate the session, do MODCD abandon connection	...X	X
X'D020'	N/A	N/A	Loss of Contact (switched line)	Reestablish the switched connection	X.XX	XX.. ...X

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS 4567	RD BITS 0123 4567
X'E020'	See Below	See Below	Session failure	via MODCD (abandon connection), MODCD (dial), etc. Reset, activate session; issue new BID REQIO if you want to try a new session. Note: ERP actions must be coordinated between the devices		
			X'0007'	Link degradation		
			X'F725'	- Sync not est timeout Data mode	.XXX	.X.. ...X
			X'F735'	- Sync not est timeout Contention mode	X.XX	XX.. ...X
			X'F765'	- Sync lost timeout	X.XX	XX.. ...X
			X'F7E5'	- VRC error	X.XX	XX.. ...X
			X'F805'	- CRC/LRC error	X.XX	XX.. ...X
			X'0008'	Far end system problems		
			X'9745'	- Cont char Sync Rcvd	X.XX	XX.. ...X
			X'9765'	- Unexpected sync record (TRIB only)	.XXX	.XX. XXXX
			X'0009'	Using program error		
			X'93A0'	- Invalid Xmit Format	..X.	.X.. XXX.
			X'F660'	- MS buffer overflow	XXXX	XX.. ...X
			X'0012'	Protocol errors, SW link not disconnected		
			X'9208'	- EOT abort	XXX.	XX.. XXX.
X'E021'	See Below	See Below	X'9388'	- EOT, forward abort	...X	..X. ...X
			X'9588'	- Remote protocol violation conv reply	..X.	.X.. XXX.
			X'F088'	- NAK to text	X.X.	XX.. XXX.
			X'F108'	- Wrong ACK	X.X.	XX.. XXX.
			X'F288'	- ENQ RCVD to text sent	X.X.	XX.. XXX.
			X'F308'	- Invalid format recvd	X.XX	XXX. XXXX
			X'F488'	- Enq Rcvd to ACK sent	X..X	X... ...X
			X'000A'	X'93F0' - BSC Protocol timeout (TRIB only)	.XXX	.XX. XXXX
			Link failure	Follow action for ND failure event 000E 05 01		
			X'0007'	Link degradation		
			X'F725'	- Sync not est timeout Data mode	.XXX	.X.. ...X
			X'F735'	- Sync not est timeout Contention mode	X.XX	XX.. ...X
			X'F765'	- Sync lost timeout	X.XX	XX.. ...X
			X'F7E5'	- VRC error	X.XX	XX.. ...X
			X'F805'	- CRC/LRC error	X.XX	XX.. ...X
			X'0008'	Far end system problems		
			X'96A5'	- Req to Xmit timeout (RLSD 3.4 seconds)	XXXX	XX.. ...X

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS	RD BITS
					4567	0123 4567
X'E022'	See Below	See Below	X'9745'	- Cont char Sync Rcvd	X.XX	XX.. ...X
			X'9765'	- Unexpected Sync Rcvd (TRIB only)	.XXX	.XX. XXXX
			X'0009'	Using program error		
			X'93E0'	- Cont sync Xmit	..X.	.X.. XXX.
			X'F660'	- MS buffer overflow	XXXX	XX.. ...X
			X'000A'	Hardware failure		
			X'8049'	- Op unit error	XXXX	XX.. ...X
			X'808B'	- Channel error	XXXX	XXX. XXXX
			X'80AC'	- CMD reject	XXXX	XX.. ...X
			X'8103'	- Post Event	XXXX	XXX. XXXX
			X'8107'	- Unidentified BSTAT	XXXX	XXX. XXXX
			X'8137'	- Read Sense Time Out	XXXX	XXX. XXXX
			X'81C3'	- IOC/CA Parity error	XXXX	XX.. ...X
			X'8204'	- DTR dropd/inact	XXXX	XX.. ...X
			X'8225'	- PR'd CMD timeout	X.XX	XX.. ...X
			X'8360'	- Line not init	XXXX	XX.. ...X
			X'8380'	- SW Line Disc Timeout	XXXX	XX.. ...X
			X'83C0'	- Invalid CMD seq	..X.	.X..
			X'8401'	- Chl Disc at IOC	XXXX	XX.. ...X
			X'84E2'	- Adapt int req T.O.	XXXX	XX.. ...X
			X'E2C4'	- RTS inac/dropped	XXXX	XX.. ...X
			X'F441'	- Data over Chl D	X.XX	XX.. ...X
			X'F481'	- Data under Chl D	..X.	.X..
			X'93F0'	- BSC Protocol timeout (TRIB only)	.XXX	.XX. XXXX
			X'000B'	Modem Errors		
			X'8224'	- DSR timeout/dropped	XXXX	XX.. ...X
			X'E2E4'	- CTS act before RTS	XXXX	XX.. ...X
			X'E324'	- CTS timeout/dropped	XXXX	XXX. XXXX
			X'000C'	Operator or set up errors		
			X'F4C2'	- Adapt over/Underrun	XXXX	XXX. XXXX
			X'0012'	Protocol errors, SW link not disconnected		
			X'9208'	- EOT abort	XXX.	XX.. XXX.
			X'9388'	- EOT, forward abort	...X	..X. ...X
			X'9588'	- Remote protocol violation conv reply	..X.	.X.. XXX.
			X'F088'	- NAK to text	X.X.	XX.. XXX.
			X'F108'	- Wrong ACK	X.X.	XX.. XXX.
			X'F288'	- ENQ RCVD to text sent	..X.	.X.. XXX.
			X'F308'	- Invalid format recvd	X.XX	XXX. XXXX
			X'F488'	- Enq Rcvd to ACK sent	X..X	X... ...X
			X'0013'	Protocol errors, SW link disconnected		
			X'9188'	- Disconnect, abort	XXX.	XX.. XXX.
			X'9408'	- Disconnect, Fwd abort	X..X	X.X. ...X
			X'E022'	Station failure		
				Follow action for CD Failure event 0004 05 01		
			X'0007'	Link degradation		
			X'F725'	- Sync not est timeout (in data mode)	.XXX	.X.. ...X

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS	RD BITS
					4567	0123 4567
		X'F735'	- Sync not est timeout (in contention mode)		X.XX	XX.. ...X
		X'F765'	- Sync lost timeout		X.XX	XX.. ...X
		X'F7E5'	- VRC error		X.XX	XX.. ...X
		X'F805'	- CRC/LRC error		X.XX	XX.. ...X
	X'0008'		Far end system problems			
		X'96A5'	- Req to Xmit timeout (RLSD 3.4 seconds)		XXXX	XX.. ...X
		X'9745'	- Cont char Sync Rcvd		X.XX	XX.. ...X
		X'9765'	- Unexpected Sync Rcvd (TRIB only)		.XXX	.XX. XXXX
	X'0009'		Using program error			
		X'F660'	- MS buffer overflow		XXXX	XX.. ...X
	X'000A'		Hardware failure			
		X'8380'	- SW Line Disc Timeout		XXXX	XX.. ...X
		X'F441'	- Data over Ch1 D		X.XX	XX.. ...X
		X'F481'	- Data under Ch1 D		.X.	.X.
		X'93F0'	- BSC Protocol Timeout (TRIB only)		.XXX	.XX. XXXX
	X'000B'		Modem Errors			
		X'8224'	- DSR timeout/dropped		XXXX	XX.. ...X
	X'0012'		Protocol errors, SW link not disconnected			
		X'9208'	- EOT abort		XXX.	XX.. XXX.
		X'9388'	- EOT, forward abort		...X	..X. ...X
		X'9588'	- Remote protocol violation conv reply		..X.	.X.. XXX.
		X'F088'	- NAK to text		X.X.	XX.. XXX.
		X'F108'	- Wrong ACK		X.X.	XX.. XXX.
		X'F288'	- ENQ RCVD to text sent		X.X.	XX.. XXX.
		X'F308'	- Invalid format recvd		X.XX	XXX. XXXX
		X'F488'	- Enq Rcvd to ACK sent		X..X	X... ...X
	X'0013'		Protocol errors, SW link disconnected			
		X'9188'	- Disconnect, abort		XXX.	XX.. XXX.
		X'9408'	- Disconnect, Fwd abort		X..X	X.X. ...X
X'E031'	Same as for E021 error	Same as for E021 error	This error signaled to all sessions other than line owners when E021 is signaled to him	Same as E021	XXXX	XXX. XXXX
X'E032'	Same as for E022 error	Same as for E022 error	This error signaled to all sessions other than line owners when E022 is signaled to him	Same as E022	XXXX	XXX. XXXX
X'E087'	ALL		SSR RD errors	User program error correct the problem as specified in MI Vol 4		
X'E087'	X'0001'	N/A	Invalid data length	User program error	..XX	.XX. XXXX

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS 4567	RD BITS 0123 4567
X'E087'	X'0002'	N/A	Invalid data specification: 1. Two xmit blocks in one REQIO 2. First xmit RD doesn't specify start sequence 3. Last xmit RD doesn't specify end sequence	User program error	..X.	.X.. XXX.
X'E087'	X'0003'	N/A	1. RD contains invalid CMD bit combination 2. Reserved field violation 3. RD command and SSR function field conflict	User program error	XXXX	XXX. XXXX
X'E087'	X'0004'	N/A	More than 255 RDs which specify ITB were encountered	User program error	..X.	.X.. .X..
X'E088'	X'0005'	N/A	Switched line bid conflict	User program error - First switched bid REQIO must agree with indicator in CD	XXXX	N/A
X'E088'	X'0006'	N/A	Invalid RD combination 1 Xmit RD and receive RD in one REQIO 2 Multiple receive RDs 3 A bid and a non bid RD in same REQIO	User program error	.XXX	.XX. XXXX
X'E088'	X'000D'	N/A	1 First RD was not a bid when in contention state 2 First RD was a bid when in data state	User program error	X.XX	XXX. XXXX
X'F03F'	X'0010'	N/A	Local user time exceeded - Too many WACKS or TTDS sent to the remote device	Issue REQIOs in a more timely fashion and/or increase the time limit in the CD.	.XXX	.XX. XXXX
X'F03F'	X'0011'	N/A	Delay time exceeded-- remote device did not accept or transmit data in the time specified in the LUD. - Too many WACKS or TTDS sent by the remote device	- Increase the time limit in the CD - Determine why the remote device is not processing data	.XXX	.XX. XXXX

5.5.4.4 Events Raised by BSC Device Management

dial out

ND Events

Class X'000E'

Type 04 ND Connection Failure
(ND will be in enabled state)

Subtype 02 XID failure - This event is signaled when no CD in the eligibility list contains the XID from the calling device or when no CD's in the eligibility list are in VARY ON PENDING state and in normal BSC protocol mode. The event related variable data contains a 2-byte XID length and 15 bytes containing the XID.

Subtype 03 Disconnect failure - A disconnect or invalid data was received before XID exchange was complete. The ND will be left in switched enabled state.

Type 05 Line Failure

Subtype 01 This event is signaled whenever an unrecoverable line error has occurred. The event-related data provides a 2-byte error code, a timestamp, and OU number. The error codes and the Error Recovery Procedure for that error are defined in Section 5.5.6.1. The ND will remain in existing state and must be varied off or auto-recovery using MODND (Continue) can be used. The inoperative flag will be set in the ND, CD, and all associated LUDs above varied off state.

This event will not be signaled during activate link processing.

CD Contact Event : (0004 04 01,02,03)

Subtype 01: Contact successful

Subtype 02: Contact unsuccessful (signaled on switched lines only) CD left in pending state. Does not apply on leased lines.

Reason Code:

'0002'X Dial operation unsuccessful
'0006'X BSC first switched operation indicator mismatch on answer
'0007'X BSC XID data does not match
'0008'X BSC ASCII translation error on this systems XID
'000B'X BSC Invalid Protocol at XID on dial out
'000C'X BSC first switched operation indicator mismatch on dial out
'000D'X BSC disconnect during XID on

These event subtypes are signaled by the MSCP upon completion of the VARY ON processing for the communication station whether it is on a leased or switched network. See MSCP Section 5.1.2 and Event Section 8.1.1 for details.

Subtype 03: Loss of contact (disconnect from far end) Because of normal disconnect after successful contact. The object state stays the same.

CD Failure Event : (0004 05 01)

Subtype 01: Inoperative

This subtype is signaled by communications management (BSC IOM component) whenever an unrecoverable station error has occurred. The event related data provides a 2-byte error code, a timestamp, and OU number. Refer to Section 5.3 for the event error codes and the recovery actions for each of these cases. Note that the set of error codes for the CD failure event, subtype 01, is common to those of the ND failure event listed in the previous section. Although not all of these codes can come up in both cases (ie, line failure versus station failure), it is not always possible to identify which component has actually failed, so recovery actions must include both possibilities. The CD is left in it's current state and must be varied off then on or auto-recovery using MODCD (Continue) can be used. The inoperative flag is set in the CD and all associated LUDs above varied off state.

CD Manual Dial Required : (0004 06 01)

This event is signaled by the MSCP to request operator assistance in making a switched line connection whenever a manually dialed communication facility is installed.

LUD Events

Class X'000B'

Type 05 Unsolicited Incoming Message

Subtype 04 Line bid received. The LUD is in varied on or higher state and a line bid is received. No event-related data is provided. A Request I/O must be issued to receive the message itself. For successive selects under multipoint tributary configurations this event will not be signaled more often than every 5 seconds.

Type 06 LUD Contact

Subtype 01 Successful contact

This event is signaled by the MSCP upon completion of the vary on processing for the BSC station. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details.

Subtype 02 LUD contact unsuccessful - Device is inoperative

Reason code 0002, unable to communicate with device.

- Type 09 Session Related Events
 - Subtype 01 Request I/O Completed
- Type 0A Response Queue Destroyed
 - Subtype 01

5.5.5 OBJECT CREATION DATA FOR SUPPORTED DEVICES

This section defines the data needed to create the objects necessary to attach a specific device to the System/38.

5.5.5.1 ND Template for BSC Devices

Field-Name	Description	Length	Data
ND Type	CD's attached	Char(2)	'00'
Physical address	Address of this line	Char(8)	
	- Reserved	Char(4)	'00'X
	- Reserved	Char(2)	'00'X
	- OU number	Char(2)	
			'0020'X Subsystem 1, Line 0
			'0021'X Subsystem 1, Line 1
			'0022'X Subsystem 1, Line 2
			'0023'X Subsystem 1, Line 3
			'0060'X Subsystem 2, Line 0
			'0061'X Subsystem 2, Line 1
			'0062'X Subsystem 2, Line 2
			'0063'X Subsystem 2, Line 3

Line definition

- Line discipline	Bit(4)	'0100'B
- Switched network	Bit(1)	'0'B = Leased '1'B = Switched (Not allowed for BSCT)
- SNBU feature	Bit(1)	'0'B = Leased '1'B = SNBU (Not allowed for BSCT)
- Data rate select feature	Bit(1)	'0'B = No '1'B = Yes
- Role	Bit(1)	'0'B = Pt-Pt '1'B = Multi-point
- NRZI	Bit(1)	'0'B = No NRZI
- Non clocked modem	Bit(1)	'0'B = No '1'B = Yes
- OEM modem	Bit(1)	'0'B = No '1'B = Yes
- 2/4 wire line SNBU	Bit(1)	'0'B = 2 Wire '1'B = 4 Wire
- 2/4 wire line leased	Bit(1)	'0'B = 2 Wire '1'B = 4 Wire
- Multipoint physical	Bit(1)	'0'B = Point-to-point '1'B = Multipoint
- Multipoint protocol	Bit(1)	'0'B = Not applicable (BSC) '1'B = Tributary (BSCT)
- Auto dial feature	Bit(1)	'0'B = Manual '1'B = Auto dial
- Auto answer feature	Bit(1)	'0'B = Manual '1'B = Auto ans
- Auto ans sequence	Bit(1)	'0'B = Seq 0 '1'B = Seq 1
- Answer tone	Bit(1)	'0'B = No '1'B = Yes
- Marks/spaces for ans tone	Bit(1)	'0'B = Spaces '1'B = Marks
- Special ans tone	Bit(1)	'0'B = No '0'B = Yes
- DCE group	Bit(2)	'00'B Integrated IBM modems out- side USA & Canada. '01'B Switched lines outside USA & Canada without IBM integrated modem '10'B Switched lines within USA & Canada

- Line speed	Bin(2)	12 = 1200 BPS 20 = 2000 BPS 24 = 2400 BPS 48 = 4800 BPS 72 = 7200 BPS 96 = 9600 BPS 480 = 48 KBPS 560 = 56 KBPS
- Secondary address	Bit(16)	BSC = zero BSCT = station poll address

Selectable Modes

- SNBU mode	Bit(1)	'0'B = Leased '1'B = SNBU (Not allowed for BSCT)
- Data rate select	Bit(1)	'0'B = Full '1'B = Half
- Char encoding	Bit(1)	'0'B = EBCDIC '1'B = ASCII
- BSC protocol modes	Bit(3)	'000'B
- Switched connect method	Bit(2)	'00'B Non Swit '10'B Dial in '01'B Dial out '11'B Either
- Auto dial mode	Bit(1)	'0'B = Manual '1'B = Auto
- Auto answer mode	Bit(1)	'0'B = Manual '1'B = Auto

5.5.5.2 CD Template for BSC Devices

<u>Field-Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
CD Type	Attached to an ND	Char(2)	'10'
Unit Type	Generic BSC controller identification	Char(4)	'BSC ' (PT-PT or MRJE) 'BSCT' (Multi-Point Trib)
Model Number	Generic BSC controller identification	Char(4)	'0000'
Physical Address	Complete Network address	(Char(8)	
	- reserved	Char(2)	binary zero
	- Bytes 2-3	Char(2)	binary zero
	- Station address	Char(2)	BSC = zero BSCT = station poll address
	- OU number of ND (nonswitched) or binary zero (if switched)	Char(2)	OU # or '0000'X
Power Control	Not Used	Char(2)	'0000'X
Station Def	BSC Link	Bit(2)	'01'B
	Link Type	Bit(1)	'0'=nonsw '1'=sw (Not allowed for BSCT)
	Role	Bit(1)	'0'=point to

	SNBU	Bit(1)	point '1'=multi point '0'=no '1'=yes (Not allowed for BSCT)
	Rate Select	Bit(1)	'0'=no '1'=yes
Mode Select	SNBU	Char(2) Bit(1)	'0'=leased '1'=SNBU (Not allowed for BSCT)
	Protocol	Bit(3)	'000'-normal BSC '001'-MTAM (Must be '000' for BSCT)
Delayed Contact Control		Char(2)	'0000'X
Delay Data	Delay (this pgm)	Char(4) Bin(2)	0-999 seconds - 120 recommended
	Delay (device)	Bin(2)	0-999 seconds - 120 recommended
			NOTE: If 999 is specified an in- finite delay time will be allowed.
Dial Digits	Phone number	Char(32)	
	Reserved	Char(6)	
	Number of digits used	Bin(2)	
	Digits	Char(16)	
	Reserved	Char(8)	
ND Candidate List	Sysptr(*)	Char(16)	sys ptr ND
Specific Characteristics Length		Bin(2)	binary zero
XID Information Area	Area Length	Char(Y+2)	'0014'X
	XID Length	Bin(2)	'0012'X
	XID	Bin(2)	These values are returned by the machine (not sup- plied by user)
	Reserved	Char(15) Char(1)	
Unit Specific Contents	Length	Char(Y+4) Bin(2)	A value 112+18y where y is the number of remote XID entries in the list following. (Y = 1 - 32 for switched CD's, Y = 0 for leased CD's)
	Modify Length Unit Specific Parameters (XID Remote List)	Bin(2) Char(VAR)	Same value as above See 5.5.5.2

5.5.5.3 Switched Line Connection Considerations

For BSC devices on switched lines or using switched backup, the following fields must be provided in the CD: Note: Switched or SNBU are not supported by BSC multi point tributary station.

- ND Candidate List (used for dial out only)
- XID Information Area--Used by machine to provide actual ID received from line.
- Unit Specific Contents
 - BSC Misc Attributes (First Switched Operation Indicator)
 - This systems XID--Used for either dial or answer connections
 - Remote XID List--Used by machine for answer connection.

Refer to System/38 Function Concepts Manual GA21-9330 for a general discussion of switched connect procedures.

The following contents must be provided in the ND in order to use a switched link.

- CD Eligibility List

A list of system pointers to BSC CDs which are to be searched for a matching XID to that XID received from the remote station when an incoming call is received.

The following contents must be provided in the CD in order to use a switched link.

- ND Candidate List

A list of system pointers to BSC NDs to be used by this CD for dial out operations. The list may contain valid SPTRs or null pointers. When a MODCD (dial) instruction is issued, the NDs in the candidate list are searched in order and one is chosen to use for this connection. The ND must meet the following conditions:

- not currently in use
- varied on and enabled
- dial out allowed

- XID Information Area

This field provides the actual XID received by the machine back to the user when the machine has successfully completed a dial in or dial out operation by matching this incoming XID against an entry in the Remote XID List.

Unit Specific Contents--Switched XIDs

- Unit Specific Contents Length: For non-switched CDs specify 112 bytes.

For switched CDs specify a value 112+18N where N is the number of remote XID entries supplied below. Maximum of 32 entries allowed with at least one required, ie, N = 1-32.

- Unit Specific Modify Length: Specify the same value as above.

This area contains the following:

- BSC Misc Attributes Char(2)
 - First Switched Operation Indicator Bit(1)
 - 0 = Device must transmit first
 - 1 = Device must receive first
 - Reserved Bit(15)
- Reserved Char(8)
- This system's XID Char(18)
 - Length of the XID (values allowed: 0; 2-15) Bin(2)
 - ID characters Note 1 Char(15)
 - Reserved Char(1)
- Number of remote XIDs in list Note 2 Bin(2)
- Reserved Char(1)
- MTAM LOGON sequence & Host Char(81)
- Remote XID List Char(VAR)
 - Length of this XID (0; 2-1) Bin(2)
 - ID characters (left justified) Char(15)
 - ID Type Char(1)
 - '00'X=specific ID value
 - '01'X=accept any remote ID

The remote XID list can contain values for the IDs as follows:

ID Type	ID Length	Meaning
'00'X	zero	only a null ID (not present) will match this ID entry
'00'X	2-15	An exact match of ID and length must take place
'01'X	Not Applicable	This ID type will cause any remote XID to be accepted. If used, it must be the last in any ID list.

Note 1 - ID characters must be left justified within this field. They cannot be assigned any of the values of the BSC link control characters. If ASCII translation is to be used, they must be translatable characters.

Note 2 - The number of remote XIDs in the list (N) may be modified (via MODCD) to any value which will be contained within the length specified on the Create CD. For example, if the length were set to the maximum value of 112+18*32, N can be any number from 1 to 32 on the create, and can be modified to any number from 1 to 32 via MODCD. Any nonzero data beyond the Nth XID is ignored on Create or Modify.

- First Switched Operation Indicator

Select to receive from the device (bit=0) or

send data to the device (bit=1) when a switched connection is first established. This is required at switched connect time, ahead of the REQIO (BID) instruction to establish direction for bid when a switched connection is initially established.

Dialing Out to a device using BSC can be performed as follows:

1. ND(s) are varied on and enabled for dial out.
2. ND SPTRs are set in the CD's ND candidate list.
3. The XID(s) to be used are set into the 'Remote XID List' field of the CD and the phone number to be used are set into the 'Dial Digits' field of the CD. CDs are varied on and LUD(s) are varied on.
4. MODCD (dial). The machine picks a line and dials the call.
5. The machine makes the connection, insures that the remote XID matches one of the entries in the 'Remote XID List', and sets the selected XID into the 'XID Information Area'.
6. The CD and LUD are brought to varied on state and the CD contact and LUD contact events are signaled.

Accepting an incoming call can be performed as follows:

1. CDs and LUDs are varied on (to pending state)
2. CD SPTRs are set into the ND's CD eligibility list.
3. NDs are varied on and enabled for dial in.
4. An incoming call is answered.
5. The machine searches the CDs in the eligibility list of the ND for a matching XID.
6. The machine sets the selected CDs 'XID Information Area' field to contain the XID length and XID value received from the far end station. If the CD accepts any ID, that XID, and XID length are placed in the XID information area.
7. The CD and LUD are brought to varied on state and the CD contact and LUD contact events are signaled.

5.5.5.4 BSC LUD Template Information

The following information is common for BSC LUDs for all devices.

<u>Field-Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	LUD attached to a CD	Char(2)	'30'
Device Type	Generic BSC device identification	Char(4)	'BSC ' (PT-PT or MRJE) 'BSCT' (Multi-point Trib) 'BSCC' (Multipoint Control Station)
Model Number	Generic BSC device identification	Char(4)	'0000'
Physical Address	LUDs complete network address	Char(8)	
- Reserved		Char(2)	binary zero
- Device addr	addr used for this LUD	Char(2)	BSC = zero BSCT = device address
- Station addr	poll addr of CD	Char(2)	BSC = zero BSCT = station poll address
- NDs OU#	ND OU# if nonswitched, binary zero if switched	Char(2)	OU# or '0000'X
Session Information	Defines the device's communication capabilities & limitations	Char(32)	
- Session Data	Defines the devices session parameters	Char(4)	
-- Contention Resolution		Bit(1)	'0'B=Slave '1'B=Master
-- Ignore RFT		Bit(1)	'0'B=Machine automatically acts as RFT responder '1'B=Machine passes all RFTs as data

All other LUD fields: Unused for BSC or BSCT

5.5.5.5 Multi-point Trib Considerations

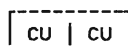
- For BSC Tributary connections, up to 32 sessions can be active. Each session can have REQIO's pending. The first REQIO per session must be a bid. When a session has a BID REQIO pending it is eligible to be polled or selected by the control station. If one of the sessions which has a REQIO pending is selected or polled and the direction of the bid REQIO matches the poll or select then that session has control of the line until either end sends an End of Transmission (EOT). While one session has control there are no transactions sent on the line for any of the other sessions. When an EOT is sent each session again becomes eligible to be selected or polled. It should be noted that the multi point trib function is completely transparent to the FM. The BIOM and IOC handle all of the controls for multi point operation.

- Station Address -- Station address is a 2 byte field provided in the ND, CD, and LUD. It is common to all multi-point trib addresses recognized by this line appearance. The address as specified in the ND must have Bit 2 ('20'X) equal to zero. This address can't be a BSC control character. If the line is ASCII, the station address must be translatable to ASCII with the hex '20'X bit off.

- Device Address -- Device address is a 2 byte address unique to each LUD connected to a particular CD. A null device address is specified by a value of '2D2D'. The device address can not be a BSC control character or cannot be '7F7F'X and must be translatable if ASCII.

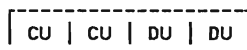
- Multi-point Trib Addressing -- The Multi-point trib addresses recognized by System/38 are a composite of the station address and the device address. Each LUD attached to a CD must have a unique device address. The addresses take 2 forms, a 2 byte address and a 4 byte address.

- 2 Byte Multi-point Trib Address



The two byte address consists only of the control unit address. Only one of the LUDs attached to a CD may specify a two byte address. The two byte address is specified by a device address of '2D2D'X.

- 4 Byte Multi-point Trib Address



A 4 byte address consists of the control unit address, followed by the device address.

- Polling -- Polling is an invitation by the control station to transmit data from the tributary to the control station. A poll is recognized by Bit 2 ('20'X) being zero in both bytes of control unit address.
 - A poll address received which does not match the control unit address specified, will not be responded to.
 - A poll address received which matches the control unit address but the device address is for a LUD which is not varied on will be responded to negatively (EOT).
 - A poll address received which matches the control unit address and the device address is for a LUD which is varied on or in suspend state will be responded to negatively (EOT).
 - A poll address received which matches the control unit address and the device address is for a LUD which is varied on and has a request I/O bid transmit pending will cause the bid transmit to complete.
 - If a valid poll is received and an online test requestor function is in progress for the polled address, the OLT function will be continued.
- Selection -- Selection is a request by the control station for the selected tributary station to receive data from the control station. A select is recognized by Bit 2 ('20'X) being a one in both bytes of control unit address.
 - A select address received which does not match the control unit address specified, will not be responded to.
 - A select address received which matches the control unit address but the device address is for a LUD which is not varied on will be responded to negatively (NAK).
 - A select address received which matches the control unit address and the device address is for a LUD which is varied on or in suspend state will be responded to negatively (NAK). A LUD event, unsolicited incoming message (000B 05 04), will also be signaled.
 - A select address received which matches the control unit address and the device address is for a LUD which is varied on but has a bid transmit request I/O outstanding will be responded to with an RVI if contention winner is specified. If contention loser is specified, the bid transmit request I/O is completed with a '5002'X feedback code. A two second timer is started. If a bid receive request I/O is received before 2 seconds elapses, an ACK0 is sent. If 2 seconds elapses before a bid request I/O is received, a negative response (NAK) is sent. A bid received request I/O received after

the 2 seconds will be handled like normal bids. If a bid transmit REQIO is received before the 2 second timer expires, an RVI is sent.

- A select address received which matches the control unit address and the device address is for a LUD which is varied on and has a bid receive request I/O outstanding will cause the bid request I/O to complete and a positive response to be sent (ACK0).

5.5.6 COMMUNICATIONS ERROR RECOVERY PROCEDURES - BSC

5.5.6.1 Network and Controller Description Failure Events

Event Class Name = Network Description

Event Class Number = X'000E'

Type = 5 (Network Description)

Subtype = 1 (Line Failure)

When an event of this class and type is received, the communications line represented by the Network Description object has become inoperative. When the event-related data error code is applied to the following table, the reason for the line failure and the suggested recovery can be determined.

The error codes x'8xxx' or x'9xxx' indicate errors of a non-retryable nature. Error codes x'Exxx' or x'Fxxx' indicate that a retryable line error has been retried up to the retry limit.

In addition to this event, an error log entry is recorded which contains more detailed information regarding hardware and microcode states. Note that there can be error log entries made for additional error codes which do not appear here since they are handled internally and are not reflected in failure events.

Event Class Name = Control Unit Description

Event Class Number = X'0004'

Type = 05 (Control Unit Description Failure)

Subtype = 01 (Controller Inoperative)

When an event of this class, type, and subtype is received, the controller represented by the Control Unit Description has become inoperative.

Applying the event-related data error code to the following table will indicate the reason and suggested recovery procedures.

The error codes X'8XXX' and X'9XXX' are of a non-retryable nature. Error codes X'Exxx' and X'Fxxx' mean the error has been retried to the retry limit.

In addition to this event, an error log entry is recorded which contains more detailed information.

Recovery Actions

Refer to the Section 5.3 for a complete listing of the hardware error codes and associated recovery actions for the failure events.

5.5.6.2 Network Description Exception Codes

S/S RESOURCE NOT AVAILABLE EXCEPTION

For BSC communications ND objects, the MODIFY ND instruction can signal the S/S Resource Not Available Exception (3404'X) for the following state change requests:

Command	Exception Data	
	Generic	Specific
Vary On	'2102'X	Hardware Error Code (activate link failures)
Manual Answer	'2103'X	Hardware Error Code (Initialize line failures)
Manual Start Data	'2104'X	None--exception will not be signaled for this case.
Enable Switched Line	'2105'X	Hardware Error Code (Initialize line failures)
Continue	'2108'X	Hardware Error Code (Initialize line failures)
Cancel	'2109'X	None--exception will not be signaled for this case.

For each of these cases, the status code provided is the same as the status code provided in the event-related data for the corresponding Line Failure Event as defined in Section 5.5.6.1. Since the exception codes will always be a subset of the event codes, the recovery action should be based on handling of the failure event rather than on the exception.

CONFIGURATION INVALID

For BSC communications ND objects, the MODIFY ND instruction can signal Configuration Invalid ('3401'X) for the following changes:

Command	Exception Data	
	Generic	Reason

Modify ND
(Selectable
Modes) '2105'X ASCII xlate
error on station addr
if ASCII mode selected

Command
Modify CD (Vary on)

Reason ND not in
normal mode (in MTAM
mode). Leased
networks only.

TEMPLATE VALUE INVALID

For BSC communications ND objects, the CREATE ND instruction can signal Template Value Invalid('3801'X) for the following new reasons:

Command	Reason
Create ND	ASCII translation error on station addr if ASCII mode selected or invalid station address SNBU feature selected for a BSC Trib ND

TEMPLATE VALUE INVALID

For BSC communications CD objects, the CREATE CD instruction can signal Template Value Invalid('3801'X) for the following new reasons:

Command	Reason
Create CD	ASCII translation error on station addr if ASCII mode selected or invalid station address SNBU feature selected for a BSC Trib CD

5.5.6.3 Controller Description Exception Codes

S/S RESOURCE NOT AVAILABLE EXCEPTION

For BSC communications CDs, the MODIFY CD instruction can signal the S/S Resource Not Available Exception ('3404'X) for the following state change requests:

Command	Exception Data	
	Generic	Specific
Vary On	'2202'X	None--exception will not be signaled for this case.
Dial Out	'2204'X	'0401'X Dial out failure due to all ND candidates being in use or not enabled.
Continue	'2208'X	Switched lines - None-exception will not be signaled for this case. Leased Line '0801'X - The corresponding failure event will have been signaled. '0802'X - Cancel status set in ND object.
Cancel	'2209'X	None-exception will not be signaled for this case.

S/S INVALID OBJECT STATE EXCEPTION

For BSC communications, the MODIFY CD instruction can signal the Invalid Object State exception ('3403'X) for the following new reason:

5.5.6.4 Logical Unit Description Failure Event

This event is not signaled for BSC or BSCT support.

5.5.6.5 LUD Exception Codes

S/S RESOURCE NOT AVAILABLE EXCEPTION

For BSC LUDs, the MODIFY LUD instruction can signal the S/S Resource Not Available exception ('3404'X) for the following state change requests:

Command	Exception Data	
	Generic	Specific
Vary On	'2302'X	None-exception will not be signaled.
Activate	'2303'X	'D016'X-Disconnect received. The LUD cannot be placed in Active Session State. A CD failure event has been signaled. 'E021'X-A line failure has occurred. The LUD cannot be placed in Active Session State. An ND failure event has been signaled. 'E022'X-A station failure has occurred. The

LUD cannot be placed in Active Session State. A CD failure event has been signaled.

Modify LUD '2302'X ASCII xlate error on device addr if ASCII mode selected in the ND or invalid device address

Continue '2308'X '1401'X-The corresponding failure event has been signaled.

'1402'X-Cancel status set in CD object.

'1403'X-Device failure.

Cancel '2309'X 'None - exception will not be signaled in this case.

Suspend Session '2312'X '1201'X-Suspend rejected due to timeout condition

Quiesce Session '2313'X '1301'X-Quiesce rejected due to timeout condition

CONFIGURATION INVALID

For BSC communications LUD objects, the MODIFY LUD instruction can signal Configuration Invalid ('3401'X) for the following new reasons:

Command	Exception Data	Generic Reason

TEMPLATE VALUE INVALID

For BSC communications LUD objects, the CREATE LUD instruction can signal Template Value Invalid('3801'X) for the following new reasons:

Command	Reason
Create LUD	Errors in the device address field.
	Station addr does not match station addr in CD.

Request I/O (synchronous)	Reason
	Errors in the RD field in the synchronous SSR

INVALID OBJECT STATE

For BSC LUD objects the MODIFY LUD instruction can signal the Invalid Object State exception ('3403'X) for the following new reason:

Command	Reason
Modify LUD (Vary On)	CD not in normal mode (in MTAM mode) for normal BSC LUD (Type 0000).

Request I/O (xynchronous)	Reason
	Sequence error. Synchronous request was issued at a time when no outstanding operations existed which require flushing or when flushing is not appropriate for the outstanding operations etc.

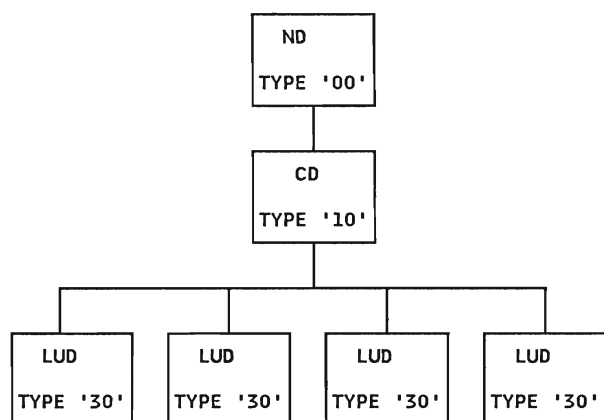
5.6 COMMUNICATIONS DEVICE MANAGEMENT--MTAM

MTAM (Multileaving Teleprocessing Access Method) supports the MRJE BSC utility. This section describes the programming considerations and specific device support requirements for MTAM. General information regarding the commands and objects can be found in the instruction writeups.

The device management supports a controller (station) or CPU and the logical unit (device) attached to the CPU. The device management performs MTAM functions necessary to complete a REQIO instruction (ie, session control, link ERP, etc.).

5.6.1 COMMUNICATIONS DEVICE ATTACHMENT

Communications object configuration for MTAM that may be defined consists of a ND, a CD, and from 1 to 23 LUDs representing the attached devices. It should be noted that along with the MTAM LUDs, a BSC LUD can be attached to the same CD though they can not be active at the same time. The LUD type requires the creation of both ND and CD objects. The specific data required in the ND for a given line type and the specific data required in the CD are covered in other sections. The maximum MTAM configuration that may be active is limited to 7 readers, a console display, a console keyboard and 7 punches or 7 printers such that the combination of printers and punches totals up to 8 devices.



Communications Object Configuration--MTAM

5.6.2 PROGRAMMING CONSIDERATIONS

Communication for MTAM is accomplished through MTAM paths. A MTAM path is activated when a REQIO (bid) is executed. To manage these MTAM paths, the device management supports the following MI instructions.

MODND: Vary On/Off/Switched Enable/Switched Disable
Manual Answer/Abandon Call/Start Data
Eligibility List/Selectable Modes
Line Specific
Continue/Cancel

MODCD: Vary On/Off
Dial/Abandon Connection
ND Candidate List/Selected Modes
Dial Digits field
Unit Specific Contents field
(SIGNON/LOGON text)
Continue/Cancel

MODLUD: Vary On/Off
Activate/Deactivate
Reset
Quiesce
Suspend
Continue/Cancel

REQIO: Functions - Normal
Control - Normal
Continue

Prior to using any of these instructions, the user must create the network describing the line-ND, the controller - CD and the device(s)-LUD. This is done by using the following MI instructions:

CRTND - Create Network Description
CRTCD - Create Controller Description
CRTLUD - Create Logical Unit Description

See appropriate instruction sections for the template data needed to create the objects for the line, station or device(s).

5.6.2.1 MI Instructions

Modify ND

MODND (Vary On/Off)

This instruction is used to activate or deactivate the MTAM communications line appearance.

MODND (Switched Enable/Disable)

This instruction is used to allow or disallow use of the switched communications line after it has been varied on. When going into switched enable mode for answer operations, the eligibility list must contain at least one valid CD pointer.

MODND (Manual Answer/Abandon Call)

This instruction is used to synchronize the hardware adapter signals with operator actions for completing or discontinuing a switched manual answer connection. Specifically, this instruction indicates that the operator has an established connection and causes the machine to initialize the line. This instruction also indicates that the attempt to establish a connection failed.

MODND (Start Data)

This instruction indicates that the operator has manually placed the modem in Data Mode, and the line is now ready for Data Communications.

MODND (CD Eligibility List)

This instruction is used to specify which CD is to be used for the switched connection. When an incoming (answer) switched connection occurs this list will be searched in order and the first CD which is in MTAM mode and in Vary On Pending state will be selected.

MODND (Line Specific)

This instruction is used to change the line specific area of the ND.

MODND (Selectable Modes)

This field is used to set this BSC ND into MTAM protocol mode prior to varying on this line.

MODND (Cancel)

This instruction is used to suspend the reconnection and reuse of the communication line.

MODND (Continue)

This instruction is used to enable (allow) the reuse of the line after an unrecoverable error has occurred.

Modify CD**MODCD (Vary On/Off)**

These instructions perform preliminary setup for the MTAM data path. Synchronous to the MODCD (Vary On) the MSCP will verify that the ND and CD are both in MTAM mode for a leased line. Part of the MODCD (Vary On) processing for a leased connection is to start an asynchronous sequence to send a SIGNON/LOGON sequence to the host. This sequence will not allow any input from the host (wait-a-bit will be on) until a REQIO is issued for a device. The invalid object state exception will be signaled if the modes don't match.

MODCD (Dial/Abandon Connection)

This instruction is used to allow the control unit to be dialed manually or automatically. The machine will select an available ND from the candidate list which must also be in MTAM mode. Part of the MODCD (Dial) processing for a switched connection is to start an asynchronous sequence to send a SIGNON/LOGON sequence to the host. This sequence will not allow any input from the host (wait-a-bit will be on) until a REQIO is issued for a device.

This instruction is also used to disconnect the line.

MODCD (Dial Digits)

This instruction is used to change the telephone number in the CD which is to be used to make the switched connection on the MODCD (dial out) operation. Since the MTAM CD may potentially represent several different far end stations which are reached through different numbers, this field should be modified prior to the dial out operation. This is necessary since the machine copies the dial digits at this time.

MODCD (Unit Specific Contents - Host & SIGNON/LOGON)

This instruction can be used to change the SIGNON/LOGON text and the host type which the machine uses (the SIGNON/LOGON text is sent to the host during the Vary On CD processing). This command should be issued before the MODCD (Vary On) command since the machine copies this text from the CD at this time on a leased connection. In the case of a switched connection the machine copies the text at MODCD (Dial).

MODCD (ND Candidate List)

This instruction can be used to specify which switched lines are to establish a dial out connection. When a dial operation for this CD is requested, the list will be searched in order, and the first ND which is in the proper mode (including MTAM mode) and not in use will be selected.

MODCD (Selected Modes)

This field is used to set the MTAM mode field prior to varying on the CD.

MODCD (Cancel)

This instruction is used to suspend the reconnection and reuse of the controller.

MODCD (Continue)

This instruction is used to enable (allow) the reuse of the controller and request that contact be established after an unrecoverable error has occurred.

Modify LUD**MODLUD (Vary On/Off)**

This instruction performs preliminary set up or shut down for the data path.

MODLUD (Activate)

This instruction is used to prepare the communication path from the System/LU to the CPU or station's LU. MODLUD (Activate) is also used to activate the LU-LU path when it is in quiesce, suspended, or reset state.

The machine Activate processing will check to verify that the proper combination of devices is being varied on (printers and punches). MTAM protocol prohibits the following combinations: punch 2 and printer 7, punch 3 and printer 6, punch 4 and printer 5, punch 5 and printer 4, punch 6 and printer 3, and punch 7 and printer 2. The resource

not available exception will be signaled if any of these combinations is attempted. The resource not available exception will also be signaled if a user attempts: to Activate a device from one of the device combinations whose counterpart had its data stream suspended and whose session had been Deactivated; or attempts to Activate a device for whose counterpart an RFT (Request Function Transmission) has been received.

MODLUD (Deactivate)

This instruction is used to deactivate the communication path from the System to the CPU or station.

MODLUD (Device Specific Area)

This instruction is used to change the LUD Device Specific Area.

MODLUD (Reset)

This instruction causes all REQIOs to be sent back to the user's return queue, in an orderly fashion, with a feedback status indicating the reset condition. This instruction also places the path in an inactive state, which can be reactivated with a MODLUD (Activate) instruction.

MODLUD (Quiesce)

This instruction will cause the machine to complete all REQIO's on the queue and return them. After returning the REQIO's, processing will be halted until the LUD has been re-activated.

MODLUD (Suspend)

This instruction causes the machine to complete the current REQIO and to halt processing any new REQIO's for this LUD until it has been re-activated.

MODLUD (Cancel)

This instruction is used to suspend the device after an unrecoverable error.

MODLUD (Continue)

This instruction is used to enable (allow) the reuse of the device after an unrecoverable error has occurred.

REQIO

This instruction is used for two purposes. First, it is used to perform I/O on the MTAM data path. Second, the REQIO (continue) is used to return the logical unit to active state after it has encountered a terminating error.

5.6.2.2 Request I/O Instruction

Refer to the Request I/O instruction for details on the REQIO instruction and its Source/Sink Request

(SSR) object.

Only one block of text can be transmitted or received per REQIO.

If no valid REQIO is available for a LUD, no user data (for this LUD) will be communicated on the link.

The machine will verify the existence of an EOF either being sent or received in a data block. If an EOF potentially exists (the proper combinations of control characters are encountered) the data block will be verified that the control characters are properly chained.

The machine will handle all RFT, GFT (Grant Function Transmission), and null control records. Any other control record will be sent to the console display LUD. Terminal signoff will also result in an event being signaled.

S/S REQUEST (SSR) GENERAL

The SSR Function Field bits have the following meanings for MTAM device management:

Bits 0-3 - The only valid value is X'8' - normal path.

Bits 4-7 - These bits define the content and type of I/O being requested. The valid values and their meanings are:

Bit 4 - Indicates that this REQIO contains a BID RD as the only RD.

Bit 5 - Indicates that an EOF is to be sent on the link after processing is completed for this REQIO.

Bit 6 - Indicates that this REQIO contains a send RD.

Bit 7 - Indicates that this REQIO contains a receive RD.

The following programming rules apply to bits 4-7.

1. For REQIO continue, bits 4-7 must all be zero.
2. EOF may be set only on a send. Bit 5 may be on only if bit 6 is on.
3. The sequence of operations specified by a sequence of REQIOs must adhere to the MTAM link protocol requirements.
4. A bid REQIO must be the first REQIO after initially activating a session.
5. A bid REQIO must be the first REQIO after an EOF passes across the link.
6. A bid REQIO occurring after a reactivation (due to a MODLUD Suspend, Reset, or Quiesce) and before an EOF is sent (or received) will result

in an event being signaled and normal completion on the bid REQIO feedback record. No event will be signaled for either console.

7. System/38 MTAM supports only batch-type data transfer on a per LUD basis.
8. If the EOF bit in the SSR is set when using the console keyboard, the machine will not verify the existence of the EOF in the data block.

Request Descriptor

This request descriptor (RD) is used for MTAM. The RD contains information which details what I/O operations to perform. The RD also provides for the length and location of the data in the source sink data area (SSD). Only 1 RD is valid per REQIO. The fields in the RD are described below:

REQUEST I/O RD FORMAT FOR MTAM

Request Descriptor		Char(16)
-	Command Field	Char(2)
--	Bid for line	Bit 0
--	Send Data	Bit 1
--	Unused by MTAM	Bit 2-3
--	RD contains start delimiter (SOHSTX or DLESTX)	Bit 4
--	Unused by MTAM	Bit 5
--	RD contains end delimiter (ETB)	Bit 6
--	Receive Data	Bit 7
--	Reserved (binary zero)	Bit 8-15
-	First Block Received Length	Bin(2)
-	Data Area Length--Send or Receive	Bin(4)
-	Receive Data Actual Length	Bin(4)
-	Data Offset	Bin(4)

RD Command Bit Descriptions

Bid for line--When this bit and either the send or receive data bits are a '1', the machine will issue a Grant Function Transmission (GFT) for punch and printer LUDs after receiving a Request Function Transmission (RFT) on the link or issue a RFT for reader LUDs. The machine will verify that the LUD and the direction of the bid are proper for all devices, ie. if send and a bid are requested, the LUD must represent an output device (reader or console keyboard). Also after an end-of-file a REQIO(bid) must be reissued to use that device. The machine will respond to the bid after verifying it. The RFT/GFT sequence will be sent on the link as scheduling permits.

Send data--When this bit is '1', the machine will transmit data across the communication link. The machine will automatically handle MTAM link level ERP.

RD contains start character--This bit indicates that the data associated with the RD starts with one of

the following MTAM start sequences: SOHSTX or DLESTX. This bit must be on if the RD is a send RD or an error will occur. This bit is not allowed for a bid or a receive RD.

RD contains end character--This bit indicates that the data associated with the RD contains an ETB. This bit must be on if the RD is a send RD or an error will occur. This bit is not allowed for a bid or a receive RD.

Receive data--This bit indicates that a receive operation is to be performed. An acknowledgment will be sent following the receipt of an ETB. This receive operation will only end when data is received for the LUD for which the REQIO was issued, when a MODLUD (reset) is executed, or after the Receive Timeout time period multiplied by the retry value has passed.

First Block Received Length - This field is used by the machine to return the data length of the block received. This field is the same as Receive Data Actual Length.

Data Length-Send or Receive--This field is used to specify the available lengths in the SSD as follows:

1. **SEND DATA**--This field specifies the actual length of the data to be sent by this RD. This length is limited to 4096 bytes and greater than 10 bytes.
2. **RECEIVE DATA**--This field specifies the total length available to the machine for receiving data and status for this RD.

Receive Data Actual Length--This field is used by the machine to return the actual length of data received during a receive operation.

Data Offset--This field contains the displacement, in bytes, to the beginning of the data relative to the SSD space pointer supplied in the REQIO instruction.

The data offset value should adhere to the following rules:

1. The send RD in a REQIO should have an offset pointing to a boundary (8) location or the machine will move the data to a properly aligned buffer.
2. The offset length must be within the space allocation.

NOTE: It is strongly recommended that the offsets for RDs point to data on the correct boundaries and the data does not cross a segment boundary. These alignments are required by the machines operational units. If the alignment is not followed a significant performance degradation will occur.

REQIO Source/Sink Data Contents (SSD)

The SSD for MTAM RDs contains data as defined by the RDs. The block must be defined by the RD. Data to be transmitted must contain link control characters.

The data must be correctly described by the RD. The maximum data block size that can be transmitted is limited to 4096 bytes and greater than 10 bytes. The maximum block that the machine will read from the link will be 4102 bytes.

For end-of file in MTAM the machine does the following:

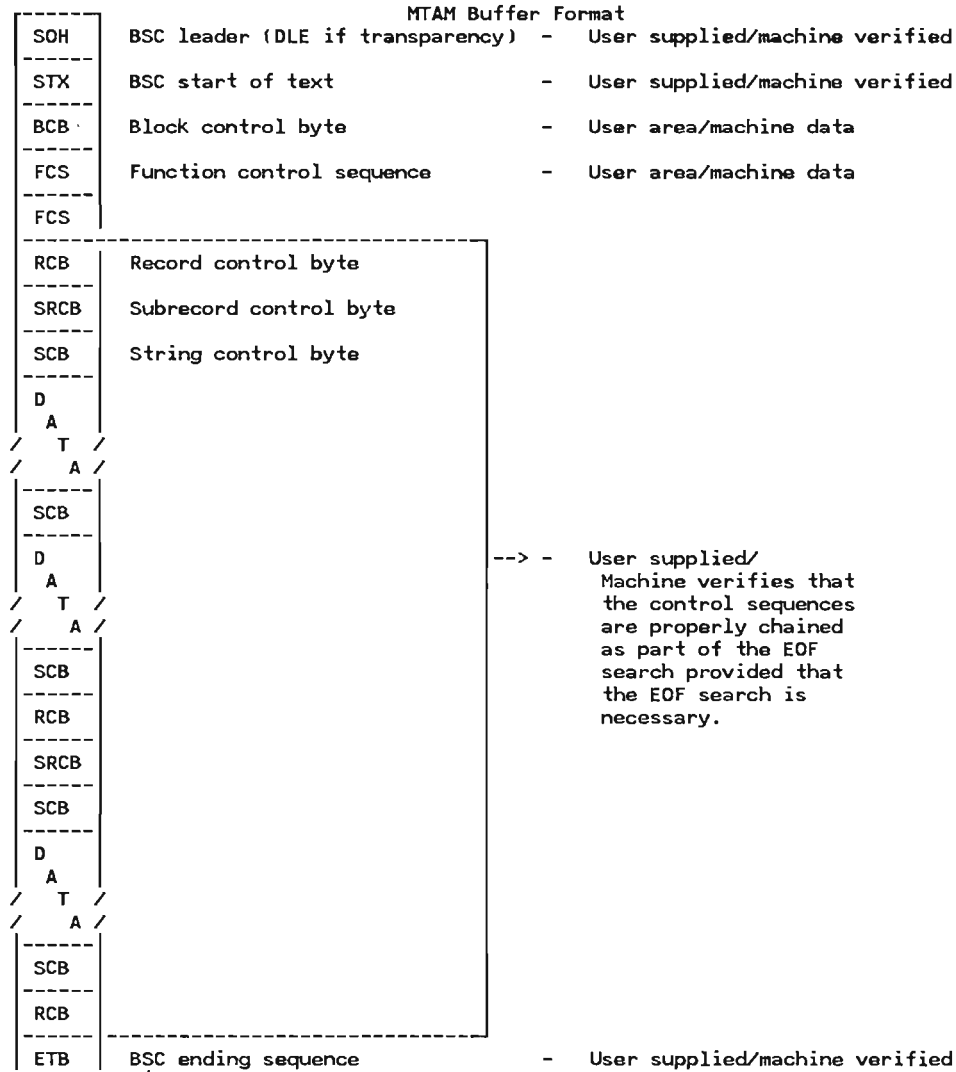
On output the machine will verify that the block contains a proper end-of-file based on MTAM protocols. For the console keyboard no EOF checking within the data will be performed.

On input the machine will check for an end-of-file and return an appropriate feedback record if an end-of-file is found. This error summary code will be in the feedback record of the first valid REQIO following the REQIO containing the EOF as part of the data.

For the console keyboard no EOF checking within the data will be performed. However, if the console keyboard SSR indicates end-of-file and the first RCB is not the console RCB, then MTAM will post a force end-of-file to the device identified by the RCB. Then MTAM will replace the RCB with the console keyboard RCB and transmit the data. The force end-of-file is posted when the next REQIO completes for that (printer/punch) device via a feedback code of '4016'X, new file received.

The MTAM buffer format is defined in the following figure. The field definitions for this buffer are defined following it.

MTAM Buffer Format



5.6.2.3 Feedback Record and Error Recovery Procedures

The format of the Feedback Record is as follows:

Bytes 00-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Timestamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for a description of the request address and request ID fields.

The error summary field defines the status of the REQIO as generally defined by the REQIO instruction description. The specific values possible for MTAM are itemized in Table 1 which follows.

The RD number is the index of the last RD processed, or the RD in error, if an error is indicated.

The RIU segment count is unused by MTAM and is set to binary zeros.

The device dependent area is binary zeros unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction.)

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log. The possible values are shown in Table 1 and further information is present in the S/38 Hardware Functional Specification.

The time stamp and OU# are the same values present in the hardware error entry.

Table 1 lists the error summary, device dependent error codes, the hardware error log codes, what caused the problem, and the recommended recovery actions.

Table 2 lists the feedback records by the different RD commands.

TABLE 1: MTAM ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS
X'0000'	N/A	N/A	No error condition	
X'0008'	N/A	N/A	Req I/O continue completion	N/A
X'0016'	N/A	N/A	Normal EOF received	Issue a REQIO with a bid seq RD or deactivate the session
X'0044'	N/A	N/A	S/S data area too small. RCVD data was truncated	Use a larger SSD to eliminate truncation
X'4016'	N/A	N/A	Force end-of-file	Issue a normal REQIO or deactivate the session.
X'5016'	N/A	N/A	Previous EOF received (for a punch or printer device type)	Issue REQIO (bid) or deactivate session
X'C009'	N/A	N/A	Part proc'd req term due to reset session	Continue cleanup
X'C00A'	N/A	N/A	Unprocessed due to reset session	Continue cleanup
X'C00B'	N/A	N/A	Partial damage	Vary off the CD and LUDs to clear this condition. A partial damage event (CD and/or LUD) has also been signaled.
X'C016'	N/A	N/A	EOF notification pending when a line or station failure occurred	Deactivate session. This error code will only occur when the MTAM IOM is holding an EOF notification and a line or station failure has occurred. The next REQIO issued by the session with EOF pending will be returned with C016. This REQIO has not been validated in any way. All REQIO's, following this REQIO will be returned with line or station failure. The line or station failure event will be signaled prior to receiving this error.
X'C041'	N/A	N/A	SSD destroyed	Provide a correct SSD, perform any higher level recovery for data which is lost, then re-issue REQIO, and issue a REQIO continue. Note that data received that would have been returned with this FBR will be lost.
X'C042'	N/A	N/A	Data does not adhere to	User program

TABLE 1: MTAM ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS
			BSC or MTAM protocols (on send operations): 1. BSC data protocol is improper. 2. The data violates MTAM protocol, ie. an SCB is improper, etc.	error. Correct buffer contents, reissue, and issue a REQIO continue.
X'C044'	N/A	N/A	Data area definition problem : 1. Area is not large enough to rec/send the data requested in the RD. 2. The data offset field is negative.	User program error. Correct RD (flds possible wrong -data offset and/or data area lgth) or replace the SSD
X'C084'	N/A	N/A	Null SSD PTR	SSD PTR must be a valid data PTR for this REQIO
X'C085'	N/A	N/A	Invalid SSR Function Field	Function field must follow rules stated
X'D016'	N/A	N/A	Disconnect : Disconnect received	DO a MODLUD Reset, Deactivate all sessions and Vary Off Luds and CD then reestablish the link via MODCD(Abandon Connection), (Dial), etc.
X'E021'	X'0007'	X'F725' X'F765' X'F805'	Link failure: Link degradation - Sync not est timeout data mode - Sync lost timeout - CRC problem	Follow action for ND failure event 000E 05 01
X'E021'	X'0008'	X'96A5' X'9745'	Link failure: Far end system problems - Req to Xmit timeout (RLSD 3.4 seconds) - Cont char Sync Rcvd	Follow action for ND failure event 000E 05 01
X'E021'	X'0009'	X'93E0' X'F660'	Link failure: Using program error - Cont sync Xmit - MS buffer overflow	Follow action for ND failure event 000E 05 01
X'E021'	X'000A'	X'8049' X'808B' X'80AC' X'8103' X'8107' X'8137' X'81C3' X'8204'	Link failure: Hardware failure - Op unit error - Channel error - CMD reject - Post event error - Unidentified BSTAT - Read sense timeout - IOC/CA Parity error - DTR dropd/inact	Follow action for ND failure event 000E 05 01

TABLE 1: MTAM ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS
		X'8225' X'8360' X'8380' X'83C0' X'8401' X'84E2' X'E2C4' X'F441' X'F481'	- PR'd CMD timeout - Line not init - SW Line Disc Timeout - Invalid CMD seq - Ch1 Disc at IOC - Adapt int req Timeout - RTS inac/dropped - Data over Ch1 Disconnect - Data under Ch1 Disconnect	
X'E021'	X'000B'	X'8224' X'E2E4' X'E324'	Link failure: Modem Errors - DSR timeout/dropped - CTS act before RTS - CTS timeout/dropped	Follow action for ND failure event 000E 05 01
X'E021'	X'000C'	X'F4C2'	Link failure: Operator or set up errors - Adapt Over/Underrun	Follow action for ND failure event 000E 05 01
X'E021'	X'0012'	X'93AB' X'F088' X'F109' X'F308'	Link failure: Protocol errors, SW link not disconnected - Wrong frmt from host - NAK to text - Wrong BCB seq ct - Invalid format recvd	Follow action for ND failure event 000E 05 01
X'E022'	X'0007'	X'F725' X'F765' X'F805'	Station failure: Link degradation - Sync not est timeout data mode - Sync lost timeout - CRC problem	Follow action for CD Failure event 0004 05 01
X'E022'	X'0008'	X'96A5' X'9745'	Station failure: Far end system problems - Req to Xmit timeout (RLSD 3.4 seconds) - Cont char Sync Rcvd	Follow action for CD Failure event 0004 05 01
X'E022'	X'0009'	X'93A0' X'F660'	Station failure: User program error - Invalid Xmit Format - MS buffer overflow	Follow action for CD Failure event
X'E022'	X'000A'	X'8380' X'F441' X'F481'	Station failure: Hardware failure - SW Line Disc Timeout - Data over Ch1 Disconnect - Data under Ch1 Disconnect	Follow action for CD Failure event 0004 05 01
X'E022'	X'000B'	X'8224'	Station failure: Modem Errors - DSR timeout/dropped	Follow action for CD Failure event 0004 05 01
X'E022'			Station failure:	Follow action for

TABLE 1: MTAM ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERROR CODE	HARDWARE ERROR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS
	X'0012'		Protocol errors, SW link not disconnected	CD Failure event 0004 05 01
		X'93AB'	- Wrong frmt from host	
		X'F088'	- NAK to text	
		X'F109'	- Wrong BCB seq ct	
		X'F308'	- Invalid format recvd	
X'E022'	X'0013'		Station failure: Protocol errors, SW link disconnected	Follow action for CD Failure event
		X'9188'	- DLE EOT invalidly sent by far end	0004 05 01
X'E087'	X'0001'	N/A	Invalid data length: 1. Length specified was greater than 4096 or less than 10 bytes on a transmit operation 2. Length specified was negative on a receive operation	User program error
X'E087'	X'0002'	N/A	RD Cmd Invalid: RD cmd combination is invalid for LUD device type (ie. pch LUD and attempted a write cmd)	User program error
X'E087'	X'0003'	N/A	Invalid command: 1.RD contains invalid CMD bit combination 2.Reserved field violation 3.RD command and SSR function field conflict	User program error
X'E088'	X'0006'	N/A	Invalid RD combination: 1.Xmit RD and receive RD in one REQIO 2.Multiple receive RDs 3.Multiple send RDs	User program error
X'E088'	X'000D'	N/A	Machine state error: 1.First REQIO was not a bid 2.RD was a bid when transferring data	User program error
X'E088'	X'000E'	N/A	Printer/Punch Conflict: 1. Bid RD was not for proper device (RFT already received). 2. Normal REQIO not processed due to RFT received for opposite device	Reset, deactivate, activate, and issue a REQIO(bid) for the correct device.

TABLE 2: FEEDBACK RECORDS BY RD COMMAND

ERROR SUMMARY	MEANING	SSR BITS				RD BITS							
		4	5	6	7	0	1	2	3	4	5	6	7
	8137 -- Read sense timeout												
	81C3 -- IOC/CA parity error												
	8204 -- DTR drop												
	8225 -- PR'd CMD timeout												
	8360 -- Line not init												
	8380 -- SW line disconnect T.O.												
	83C0 -- Invalid CMD seq												
	8401 -- Channel disconnect												
	84E2 -- Adapt int req T.O.												
	E2C4 -- RTS inactive or drop												
	F441 -- Data overrun												
	F481 -- Data underrun												
	All 000B Group -----	X	X	X	X	X	X			X		X	X
	8224 -- DSR drop												
	E2E4 -- CTS before RTS												
	E324 -- CTS Timeout												
	All 000C Group -----	X	X	X	X	X	X			X		X	X
	F4C2 -- Adapt over/underrun												
	All 0012 Group -----	X	X	X	X	X	X			X		X	X
	93AB -- Wrong frmt from host												
	F088 -- NAK to text												
	F109 -- Wrong BCB seq count												
	F308 -- Invalid format rcv'd												
	All 0013 Group -----	X	X	X	X	X	X			X		X	X
	9188 -- DLE EOT invalidly sent												
E087	0001 -- Invalid data length		X	X		X			X		X	X	X
	0002 -- RD Cmd Invalid	X	X	X		X	X					X	
	0003 -- Invalid command	X	X	X	X	X	X			X		X	X
E088	0006 -- Invalid RD combination		X	X	X		X			X		X	X
	000D -- Machine state error	X	X	X		X	X					X	
	000E -- Printer/Punch Conflict	X				X						X	

5.6.3 OBJECT DATA FOR SUPPORTED DEVICES

This section defines the data needed to create the objects necessary for a specific device to the System/38. There is a section for each object used.

5.6.3.1 ND Template for MTAM

<u>Field Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
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ND Type

(Same as BSC, see Section 3.3.1.4.)

Physical Address

(Same as BSC, see Section 3.3.1.4.)

ND Line Definition

(Same as BSC, see Section 3.3.1.4.)

ND Selectable Modes

- BSC Protocol Modes: MTAM ('001'B)
- BSC Character Encoding (ASCII/EBCDIC):
Only EBCDIC is supported
(Same as BSC, see Section 3.3.1.4.)

Communication Subsystem Parameters

(Same as BSC, see 3.3.1.4.)

Eligibility Object List

(Same as BSC, see Section 3.3.1.4.)

Specific characteristics

(Same as BSC, see Section 3.3.1.4.)

Retry Values Sets

The 3 retry sets (with ranges from 0-21) have the following meaning:

- Error during contention
For MTAM this controls the number of times the machine will send ENQ to a host before terminating the attempt. This field will be multiplied by 10 by the machine to determine the total number of attempts. Each time a retry is attempted, the machine will wait 3 seconds. It should be noted that the line is established and the user is being charged for its use. This limit is used on both switched and leased retries.
- Error during data transfer
For MTAM this is the number of times a command will be retried if a hardware or protocol error is encountered. This retry limit is also used to retry the LOGON/SIGNON sequence on a leased or a switched connection.
- Switched connection retry
For MTAM this controls the number of times a dial will be attempted.

Line Specific Contents

(Same as BSC, see Section 3.3.1.4.)

5.6.3.2 CD Template for MTAM

Field Name	Description	Length	Data
CD Type	(Same as BSC, see Section 5.5.5)		
Unit Type	(Same as BSC, see Section 5.5.5)		
Model Number	(Same as BSC, see Section 5.5.5)		
Physical Address	(Same as BSC, see Section 5.5.5)		
Power Control	(Same as BSC, see Section 5.5.5)		
Dial Digits	(Same as BSC, see Section 5.5.5)		
Station Control	(Same as BSC, see Section 5.5.5)		
Station Def	- Role	Bit(1)	'0'B=PP
	(Same as BSC, see Section 5.5.5)		
Mode Select	- Protocol	Bit(3)	'001'B=MTAM
	(Same as BSC, see Section 5.5.5)		
Delayed Contact Control	(Same as BSC, see Section 5.5.5)		
Delay Data	(Unused by MTAM)		
Specific Characteristics	(Same as BSC, see Section 5.5.5)		
Unit Specific Contents Area			
Unit Specific Length		Bin(2)	'0070'X
Unit Specific Modifiable Length		Bin(2)	'0070'X
Unused by MTAM		Char(30)	
Reserved		Char(1)	
LOGON sequence & Host		Char(81)	
HOST Host type		Char(1)	'1' RES '2' JES2 '3' JES3 '4' RSCS
SIGNON/LOGON	SIGNON/LOGON text	Char(80)	

Switched Line Connection Considerations

Refer to S/38 Functional Concepts Manual for a general discussion of switched connect procedures.

The following contents must be provided in the ND in order to use a switched link.

- CD Eligibility List

The list of pointers to the CD's which are to be used when a call is received. It should be noted that the first CD that is in Varied On Pending state and in MTAM mode will be used. If none are found then a ND connection failure event will be signaled.

For MTAM devices on switched lines or using switched backup, the following fields must be provided in the CD:

- ND Candidate List (used for dial out only)

This is a list of system pointers to NDs of which the first MTAM ND found will be used by this CD for dial out operations. The list may contain valid SPTRs or null pointers. When a MODCD (dial) instruction is issued, the NDs in the candidate list are searched in order and one is chosen for this connection. The ND chosen must meet all the following conditions:

- not currently in use
- varied on and enabled
- dial out allowed
- MTAM mode

- Unit Specific Contents (SIGNON/LOGON & Host type)

This field is used by the machine as the SIGNON/LOGON text to send to the host. This area will be put on the link after it is properly framed with control characters (this is done by the machine). This area must meet all the requirements of the SIGNON/LOGON text (the host system defines what this text must contain). The host type must also be defined in the first byte of this area.

Dialing out to a device using MTAM can be performed as follows:

1. ND(s) are varied on and enabled for dial out.
2. ND SPTRs are set in the CD's ND candidate list.
3. The CD's dial digits set for the dial and the SIGNON/LOGON text is placed in the CD.
4. Vary on the CD and LUD(s).
5. MODCD (Dial). The machine picks a line and dials the call.
6. The machine makes the connection and uses the SIGNON/LOGON text from the CD Unit Specific area.
7. The CD and LUDs are brought to varied on state and the CD contact and LUD contact events are signaled.

Accepting an incoming call can be performed as follows:

1. CD and LUDs are varied on (to pending state).
2. CD SPTR is set or modified into the NDs CD eligibility list.
3. ND's are varied on and enabled for dial in.
4. An incoming call is answered.
5. The machine locates the MTAM CD in the CD eligibility list (the first MTAM CD listed in Vary On pending state).
6. The SIGNON/LOGON sequence is sent to the host.
7. The CD and LUDs are brought to varied on state and the CD contact and LUD contact events are signaled.

5.6.3.3 LUD Template for MTAM

The LUDs are defined as follows:

Field Name	Description	Length	Data
LUD Type	(Same as BSC, see Section 5.5.5)		
Device Type	(Same as BSC, see Section 5.5.5)		
Model Number	Model Number	Char(4)	'0001'X
Physical Address	Reserved	Char(2)	
	MTAM device selection	Char(2)	
		hex 0001	console keyboard
		hex 0002	console display
		hex 0011	reader 1
		hex 0012	reader 2
		hex 0013	reader 3
		hex 0014	reader 4
		hex 0015	reader 5
		hex 0016	reader 6
		hex 0017	reader 7
		hex 0021	printer 1
		hex 0022	printer 2
		hex 0023	printer 3
		hex 0024	printer 4
		hex 0025	printer 5
		hex 0026	printer 6
		hex 0027	printer 7
		hex 0031	punch 1
		hex 0032	punch 2
		hex 0033	punch 3
		hex 0034	punch 4
		hex 0035	punch 5
		hex 0036	punch 6
		hex 0037	punch 7
	Reserved	Char(2)	
	OU number	Char(2)	

Session Information
(Unused by MTAM)

Note: All other LUD fields are unused by MTAM.

5.6.4 EVENTS RAISED BY MTAM

ND Events Class X'000E'

• Type 04 ND Failure

Subtype 04 No MTAM CD in varied on pending state and in BSC MTAM protocol mode was found in the CD eligibility list or the CD is not in the proper mode (on answer only).

• Type 05 Line Failure

Subtype 01 This event is signaled whenever an unrecoverable line error has occurred. The event-related data provides a 2-byte error code, a timestamp, and OU number. The error codes and the error recovery procedures for that error are defined in the Communication Error Recovery Procedures section. This event will not be signaled during activate link processing.

CD Events Class X'0004'

• Type 04 CD Contact

Subtype 01 Successful contact

Signaled when the host sends acknowledgment to System/38 after SIGNON/LOGON is sent.

Subtype 02 Unsuccessful contact

This event will be signaled if:

1. Dial failure (reason code = 0002).
2. SIGNON/LOGON text or HOST type improper (machine checks that the SIGNON/LOGON text is nonzero and nonblank and that the HOST type is valid - reason code = 0009). To recover from this error on a leased line the CD must be varied off and on again or auto-recovery using MODCD(Continue) can be used. If the error occurs on a switched line the switched operation must be redone. The SIGNON/LOGON text and HOST type must be corrected. If the error persists contact the host operator to see if there is a problem.
3. Host rejected or sent an invalid response to the SIGNON/LOGON text (this could be due to the host type being incorrect - reason code = 000A). To recover from this error on a leased line the CD must be varied off and on again or auto-recovery using MODCD(Continue) can be used. If the error occurs on a switched line the switched operation must be redone. The SIGNON/LOGON text and HOST type should be verified and corrected if in error. After verification the recovery can take place. If the error persists contact the host operator to see if there is a problem.
4. The host sent invalid data before the SIGNON/LOGON text was sent (reason code = 000B). To recover from this error on a leased line the CD must be varied off and on again or auto-recovery using MODCD(Continue) can be used.

If the error occurs on a switched line the switched operation must be redone. If the error persists contact the host operator to see if there is a problem.

5. The host drops the connection (disconnect on the line before SIGNON/LOGON is sent - reason code = 000D). To recover from this error on a leased line the CD must be varied off and on again or auto-recovery using MODCD(Continue) can be used. If the error occurs on a switched line the switched operation must be redone. If the error persists contact the host operator to see if there is a problem.

Subtype 03 Loss of contact

In the event that contact is lost, this event is signaled after the VARY ON processing for the communication station for both switched and non-switched controllers. See MSCP section 5.1.2 and Event section 8.1.1.

This event will be signaled when:

The host sends disconnect after the machine has signaled successful contact. If this happens it will be after the SIGNON/LOGON is acknowledged.

To recover from this error on a leased line, the CD and LUDs must be Varied Off and ON or auto-recovery using MODCD(Continue) can be used. If on a switched line the switched operation must be performed again.

• Type 05 CD Failure Event

Subtype 01 Inoperative

This subtype is signaled by the machine whenever an unrecoverable error has occurred. The event related data provides a 2-byte error code, a timestamp, and OU number. Refer to the Communication Error Recovery Procedures section for the event error codes and recovery actions.

Subtype 04 BSC/MTAM Protocol Considerations

The error code field of the event is composed of the following 2 hex bytes concatenated together. All the other fields in the event related data are zeros.

Reason Code	Other Data
01	SRCB RFT received. The CD is in varied

on or higher state and RFT was received. The SRCB data received from the host is provided as event-related data. This event will be signaled if the LUD has not been Varied On. The LUD should be varied on, activated, and a bid issued.

02 N/A Terminal signoff received from the host. Host should be sending a disconnect (DLE EOT) on the next transmission and the line should be dropped. This control record (along with any associated data) will be sent to the console display LUD.

03 SRCB RFT received. The LUD is in varied on or higher state and RFT was received. The SRCB data received from the host is provided as event-related data. A REQIO(bid) must be issued to enable sending a GFT. This event will not be signaled if a REQIO(bid) has been issued to the LUD getting the RFT.

04 RCB Unsolicited data discarded. The RCB address provided specifies a device for which data will be discarded. This is due to the host sending data in for a device that is not active or has been deactivated before all its data has been received.

• Type 06 CD Manual Dial Required

Subtype 01 This event is signaled by the MSCP to request operator assistance in making a switched line connection whenever a manually dialed connection facility is installed. The reason code = 0001.

LUD Events Class X'000B'

• Type 05 Unsolicited Incoming Message

Subtype 07 Suspended Stream Data Received Text data was received from the host to a suspended stream (suspended by the machine). The data received from the host will be held until a REQIO is sent down. No I/O on the link will occur until the REQIO for that device is issued (all devices will be held).

Subtype 08 Previously Stopped Stream Starting Up A data stream previously stopped is being restarted. The data stream will be continuing from where it left off. A REQIO(bid), if used, will be returned with good status and no line operation will occur. This event can happen for all devices except either console. This will happen if a session goes to inactive state and back to activate state without an EOF on the link. This event will only be

signaled if a MODLUD(activate, resume) is issued and a previously stopped stream is being restarted.

Subtype 09 Incoming Data Discarded
A data buffer from the host has been lost because no REQIO is available to place the received data. This event will be signaled only after LUD event subtype 07 has been signaled and data is received from the host before a REQIO has been issued to retrieve the data that subtype 07 was issued for.

Subtype 10 Device Conflict
RFT received for a device which conflicts with a currently active device whose bid sequence has not been completed. This is an invalid device combination (see the MODLUD(Activate) instruction under the MI Instruction section for the valid device combinations. The RFT received will be saved and will be honored when the correct session is activated.

• **Type 06 LUD Contact**

Subtype 01 Successful contact

Subtype 02 Unsuccessful contact
The device has become inoperative - reason code = 0002

• **Type 09 Session Related Events**

Subtype 01 Request I/O Completed.

• **Type 0A Response Queue Destroyed**

Subtype 01

5.6.5 COMMUNICATIONS ERROR RECOVERY PROCEDURES - MTAM

NOTE : It is likely that on a station/line failure, the operations required to recover the error will also fail, thus the operation will be repeated again.

Network Description Events

Event Class Name = Network Description

Event Class Number = X'000E'

Type = 5 (Network Description)

Subtype = 1 (Line Failure)

When an event of this class and type is received, the communications line represented by the Network Description object has become inoperative. When the event-related data error code is applied to the following table the reason for the line failure and the suggested recovery can be determined.

The error codes X'8XXX' and X'9XXX' indicate errors of a non-retryable nature (see NOTE 1). Error codes X'EXXX' and X'FXXX' indicate that a retryable line error has been retried up to the retry limit.

In addition to this event, an error log entry is recorded which contains detailed information regarding hardware and microcode states.

NOTE 1 : An exception is error code '84E2'X (adapter interrupt request) which is a retryable error.

Controller Description Events

Event Class Name = Control Unit Description

Event Class Number = X'0004'

Type = 05 (Control Unit Description Failure)

Subtype = 01 (Controller Inoperative)

When an event of this class, type, and subtype is received, the controller represented by the Control Unit Description has become inoperative.

Applying the event-related data error code to the following table will indicate the reason and suggested recovery procedures.

The error codes X'9XXX' and X'8XXX' are of a non-retryable nature (see NOTE 1 above). Error codes X'FXXX' and X'EXXX' mean the error has been retried to the retry limit.

In addition to this event, an error log entry is recorded which contains more detailed information.

Error Recovery Actions

Refer to Section 5.3 for a complete listing of the hardware error codes and associated recovery actions for the failure events.

5.6.6 EXCEPTION CODES

ND Exception Codes

S/S Resource Not Available Exception ('3404'x)

Refer to Section 5.3.3.8, Communications ERP, for this exception. For each of these cases, the status code provided is the same as the status code provided in the event-related data for the corresponding Line Failure Event. Since the exception codes will always be a subset of the event codes, the recovery action should be based on handling of the failure event rather than on the exception.

CD Exception Codes

Invalid Object State Exception ('3403'X)

For MTAM communications CDs, the MODIFY CD instruction can signal the Invalid Object State Exception ('3403'X) for the following state change requests:

Command	Reason
MODCD (Vary On)	ND and CD not in MTAM mode - leased only

S/S Resource Not Available Exception ('3404'X)

Refer to section 5.3.3.8, Communications ERP, for this exception.

LUD Exception Codes

Invalid Object State Exception ('3403'X)

With MTAM support, the MODIFY LUD instruction can signal the Invalid Object State Exception ('3403'X) for the following state change requests:

Command	Reason
MODLUD (Vary On)	CD not in MTAM mode if this is an MTAM LUD. CD not in normal mode if this is a normal BSC LUD.

S/S Resource Not Available Exception ('3404'X)

Refer to section 5.3.3.8, Communications ERP, for this exception.

5.7 ADVANCED PROGRAM TO PROGRAM COMMUNICATIONS (APPC)

This section describes the programming considerations and specific support requirements for interconnected systems services (APPC). The link protocol characteristics may be either primary or secondary SDLC and are determined when the ND object is created.

The general information regarding the commands and objects can be found in the instruction writeups.

The APPC management operates on behalf of a processor(CPU) and the logical units connecting that CPU to another Processor(CPU). The APPC management performs the SNA functions necessary to complete a REQIO instruction (ie, Path Control, CPM.SEND, CPM.RCV, Session Control, and Data Flow Control).

Under secondary support two PU types are supported: PEER and PU2. PU2 CD's allow the connection of three device types. These are PLU1 (3770 Emulation), PLU1 Model 0001 (3270 Emulation), and PEER devices. These device types can all execute concurrently.

5.7.1 LU SERVICES OBJECTS

OVERVIEW

In the APPC environment,controller descriptions (CDs),and logical unit descriptions (LUDs) take on a slightly new definition. APPC LUDs do not represent devices like 5250 LUDs. An APPC LUD represents a group of paths to another CPU and a group of these attached to a CD represent a set of parallel independent path 'groups' to another CPU.These paths are referred to as assignable sessions. This means that an APPC LUD has no device unique data in it like model number, screen size, but it does have unique SNA BIND information. When a user program opens a file using APPC LUD, a conversation on an available 'session' is allocated to that file. Other sessions on the same LUD are still available to be

used by other files under the same or other processes.

The S/38 user must, through the configuration commands, configure the LUD to represent the conversations and sessions by specifying the maximum number of conversations and sessions he wants to run concurrently under that LUD. He must also specify how many sessions he wants to automatically bind when the LUD is varied on-line and contact is made with the other system. The remainder of the sessions will be held in reserve for either dynamic initiation or initiation by the remote CPU. HALF-SESSIONs will be automatically created for the number of sessions to be initialized by this system. HALF-SESSIONs for the sessions initialized by the remote system and for the 'overflow' sessions will be dynamically created.

APPC Object Structure

APPC has five levels of structure:

- Network Description

This level defines the SDLC Line connecting the two CPUs.

- Controller Description

This level defines the Peer system.

- Logical Unit Description

This level defines a group of paths(pipes) and conversations to a Peer CPU.

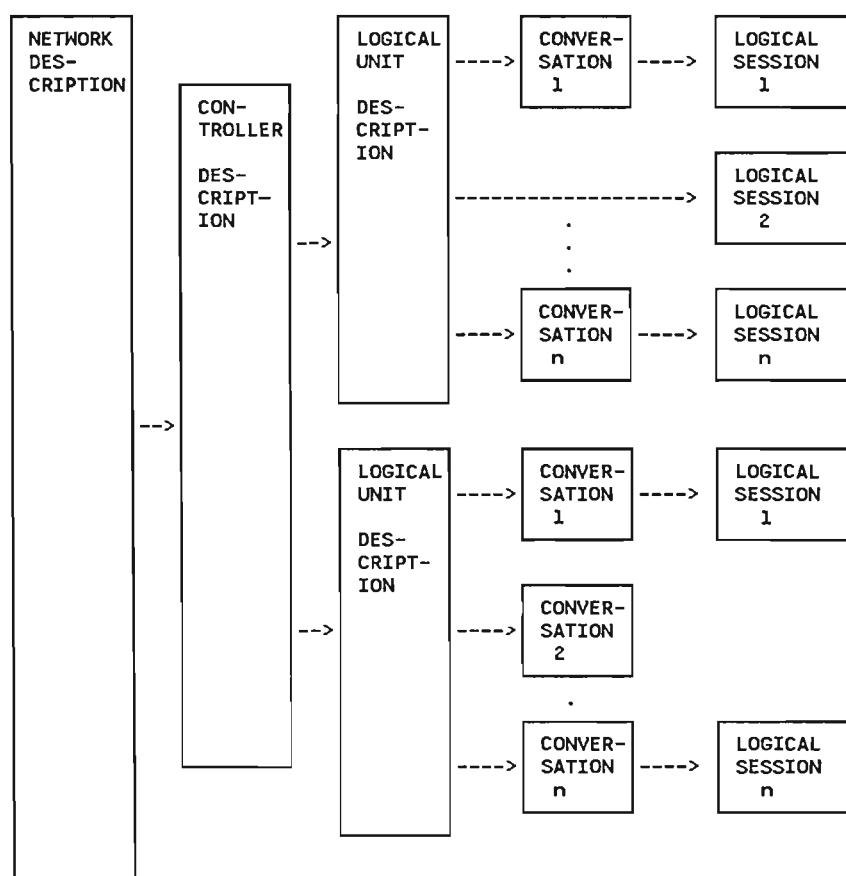
- Conversation

This level defines the current conversation(Bracket) which is being performed.

- Logical Session

This level defines the logical connection to the Peer system. It defines the 'session' through which requests and responses on a conversation will flow.

The structure may be visualized in the following manner:



The general properties of the above structure are:

- The life of a Logical Session is defined by BIND/UNBIND.
- The life of a Conversation in relation to the Logical Session is defined by BB/CEB.
 - Only one Conversation may be connected to a Logical Session at a time.
- The life of a Conversation in relation to the Transaction Program is defined by 'ACTRSRC'/'DACTRSRC'.

TARGET SYSTEM

- BB allocates a Conversation to a Logical Session.
- Attach(FMH5) allocates the Conversation to a Transaction Program.
- CEB deallocates the Conversation from the Logical Session

-- A program may continue to receive data from a Conversation after it has been deallocated from the Logical Session.

-- When the Conversation queue has been exhausted the only option available to the application program is to CLOSE.

- 'DACTRSRC' deallocates the Conversation from the Transaction Program.

SOURCE SYSTEM

- 'ACTRSRC' allocates the Conversation to a Transaction Program and allocates a Logical Session (MSCP-LU or SNA) to the Conversation.
- CEB deallocates the Conversation from the Logical Session (Contention-loser only).
- 'DACTRSRC' deallocates the Conversation from the Transaction Program and from the Logical Session.

5.7.2 LU SERVICES OBJECT CREATION DATA

This section defines the data needed to create the objects necessary to attach a specific Logical Unit to S/38 APPC. There is a section for each object supported.

5.7.2.1 Network Descriptor (ND)

The ND is used to identify the Operational Unit Numbers and the parameters needed to initialize them. It also provides linkage to the Controller Descriptor and the Logical Unit Descriptors connected to it.

The 'IOC Wakeup' code uses the ND parameters to issue the IOC startup and Initialize commands. These commands make the IOC ready for normal operations.

ND TEMPLATE VALUES

There is no change to the ND Template for APPC. The Exchange-ID field will be used for both Primary and Secondary DLC as APPC requires full XID exchange at

SDLC contact time. This change means that the machine will now generate internal XID values for either primary or secondary ND's in the same manner as was previously done only for secondary. Refer to Section 5.7.5 of this document for details.

5.7.2.2 Controller Description (CUD)

The CD is used to describe the Peer CPU characteristics, SNA transmission parameters, and Peer CPU configuration. The Peer CPU characteristics consist of its station address, and connection technique. The SNA parameters indicate the physical unit type, number of buffers, size of the buffers, and transmission header type. The Peer CPU configuration consists of a chained list of logical units attached to the CD. The Logical Units can be APPC(PEER) LUDs only.

The PU2 CD will allow the attachment of all PLU-1 LUD's as well as PEER LUDs. This configuration requires that full communication with a T4/T5 node be supported.

CD Template Values

ELEMENTS CONTAINED IN CD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
.CD Definition Data	Char(16)		D	N	D		
-CD Type -Device Type -Model Number -Reserved		Char(2) Char(4) Char(4) Char(6)				CONTROL UNIT THAT IS ATTACHED TO A ND The Controllers IBM product number The Controllers Model Number	'10' 'PEER' '0000' binary zeros
.Physical Definition Data	Char(16)		D	N	D		
-Physical Address .Reserved .Station's Line address .Operational Unit Number (OU#) -Power Control -Reserved		Char(8) Bin(4) Bin(2) Bin(2) Char(2) Char(6)				Controllers complete network Address These four bytes always zero Station's Line Address: CE will supply OU # of the corresponding ND if a leased line. Not used	'00000000'X '0001'x to '00FE'X CE will supply '0000'X binary zeros
.Station Control Information	Char(32)		D	N	D	This data describes the station and its operating modes	
-XID Information .XID format		Char(21) Bit(4)				Layout directly from SNA INDICATES USAGE OF THE VARIABLE length format. PU Type 2 which implies FID2	'3'X
.Physical Unit Type (PU)		Bit(4)				PU Type 2 which implies FID2	'2'X
.XID Information Length		Bit(8)				transmission headers Length of this variable format	'1D'X
.Station's Name -Block # -Specific ID		Char(4) Bit(12) Bit(20)				Manufacturing assigned product number User assigned ID or product mfg. ID used to ensure unique IDs on a line. This indicates segments are allowed and PU can receive RUs from SSCP.	Product block # Unit ID
.PU Characteristics		Bit(8)					'20'X
.Reserved		Char(2)					'0000'X
.DLC TYPE		Char(1)					'01'X
.Reserved		Char(1)					'00'X
.Maximum length received		Bin(2)				THIS FIELD SPECIFIES THE MAXIMUM LENGTH FOR THE BASIC TRANSMAPPICION unit (TH RH RU)	'0020'X
.Reserved		Char(4)					'00000000'X
.Frames Limit		Bit(8)				SDLC maxout count: number frames that can be transmitted before acknowledgement is needed. NOTE: The device management task always uses this field as it is presented by the station at execution time.	'0001'X to '0007'X
.Reserved		Char(3)					'000000'X
-Station Definition		Char(1)				Defines the type of connection and role played by the station	
.SDLC Link		Bit(2)					'10'B
.Link Type		Bit(1)					'0'B - Nonswitched '1'B - Switched
.Stations role		Bit(1)					'0'B - N/A
.Switched Network Backup Feature		Bit(1)					'0'B - No backup '1'B - Sw. backup
.Data Rate Selection Feature		Bit(1)				This field will be set to the correct value at CD Contact time	'0'B - No Modem feature '1'B - Yes, has

CD Template Values

ELEMENTS CONTAINED IN CD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
.Reserved -Reserved -Path Information Unit Type -Reserved		Bit(2) Char(2) Bin(2) Char(6)				SNA transmission header (TH) that station uses	feature '00'B '0000'X '0002'X : FID2 binary zeros
.Selected Mode Data	Char(16)		D	D	D		
-Selected Modes		Char(2)				Defines user selectable features. Indicates station is to run in a leased environment. Indicates station is to run in a switched network backup environment. NOTE: SNBU must be specified in the Station definition field	'0000'X '1000'X
-Delayed Contact Control		Char(2)				Delayed Station Contact Control	'0000'X - not in effect '0100'X - IN effect
-Reserved		Char(12)					binary zeros
.Activate Physical Unit Data	Char(16)		D	N	D	Activate Physical Unit Data	
-ACTPU required -Request Code -Type Activation		Char(1) Char(1) Char(1)					'00'X '11'X - ACTPU '01'X - Cold '02'X - ERP '01'X - PROFILE
-Profiles -SSCP-ID .PU Type		Char(1) Char(6) Char(1)					
.Implementation and installation dependent ID		Char(5)					
-Reserved		Char(6)					binary zeros
.Dial Digits	Char(32)		D	D	D	Phone number if a switched station	
-Reserved -Length -Digits		Char(6) Bin(2) Char(16)				Number of dial digits Actual phone number. May only contain digits 0-9 or separator (SEP) character '7D'X or End of Number (EON) character '5C'X. These two special patterns are represented by the apostrophe and asterisk keys on EBCDIC keyboards.	binary zeros
-Reserved		Char(8)					binary zeros
.Specific Characteristics	Bin(2)		D	N	D	N/A	'0000'X
.XID Information Area						Work area used for XID data received from remote station	
-Length of XID Data -XID Data		Bin(2) Char(20)				Area to hold station's execution time XID data	'0014'X Ignored at create time

CD Template Values

ELEMENTS CONTAINED IN CD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
.Unit Specific Data Area			D	D	D		
-Length of unit specific area		Bin(2)					'0002'X
-Length of modifiable area		Bin(2)					'0002'X
-Unit Specific Contents Area	Char(2)						binary zeros

LEGEND OF CRT, MOD, AND MAT KEYS

N - Data fields which are ignored by, not used by, or not applicable to the create, modify, or materialize instructions.

D - Data to be used in creation or modification, or data that can be materialized.

5.7.2.3 Logical Unit Description (LUD)

The LUD is used to describe the characteristics of the Logical Unit, LUNAME as viewed by the Network. There exists one LUD per LUNAME and there exists one LUNAME per Local Address. The Local Address is defined in the DAF field of the LUD and the LOCADDR field on the LU Macro in the ACF/NCP/VTAM Generation. Each LU supports Parallel Sessions.

The LUD also defines the Mode Names that apply to this LUNAME. There is one set of Mode Name attributes in the VMC portion of the LUD for each

Mode Name to be associated with the LUNAME. The Mode is selectable through the ACTIVATE RESOURCE REQIO. These structures allow future enhancements to APPC with a minimum of disruption to the design (e.g. S/370 Boundary Function support, Directory Services routing, Class of Service Selection).

The APPC LUD may be attached to the "PU2" and "PEER" CD.

LUD TEMPLATE VALUES

ELEMENTS CONTAINED IN LUD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
.LUD Definition Data	Char(16)		D	N	D		
-LUD Type -Device Type -Model Number -Reserved		Char(2) Char(4) Char(4) Char(6)				LOGICAL UNIT THAT IS ATTACHED TO A CD THE DEVICES IBM PRODUCT NUMBER The Devices Model Number	'30' 'PEER' '0000' binary zeros
.Physical Definition Data	Char(16)		D	N	D		
-Physical Address .Reserved .LU Address .Station Line Address .OU# same as in ND -Power Control -Reserved		Char(8) Char(2) Char(2) Char(2) Char(2) Char(2) Char(6)				Logical Units complete Network Address UNIQUE IDENTIFIER Same Address as in CD for this LU Same Number as in ND N/A	binary zeros '0001'X -'00FE'X '0000'X binary zeros
.Session Definition Data	Char(32)		D	D	D		
-Session Information .Inbound Pacing .Outbound Pacing .RU buffer Size .Reserved .ACTLU Control .ACTLU Parameters .ACTLU Parameters .ACTLU Response .ACTLU Response .Reserved		Bin(2) Bin(2) Bin(2) Char(2) Char(1) Char(3) Char(8) Char(12)				DEFINES NUMBER TRANSMAPPCTIONS BEFORE a pacing response is needed. DEFINES NUMBER TRANSMAPPCTIONS BEFORE a pacing response is needed. MAXIMUM REQUEST UNIT LENGTH Indicates that an ACTLU is not required FOR THIS DEVICE. SNA ACTLU DATA FOR THE DEVICE RETURN AREA FOR ACTLU RESPONSE	N/A N/A N/A binary zeros '00'X-N/A '000101'X binary zeros
.Load/Dump Definition	Char(16)		D	N	N	N/A	binary zeros
.Specific Characteristics	Bin(2)		D	N	N	N/A	binary zeros
.Retry Value Sets	Bin(2)		D	N	N	N/A	binary zeros
.Error Threshold Sets	Bin(2)		D	N	N	N/A	binary zeros
.DEVICE SPECIFIC CONTENTS -LENGTH OF DEVICE Specific Area -LENGTH OF MODIFIABLE Area	Char(N)	Bin(2) Bin(2)	D	D	D	LENGTH OF THE DEVICE SPECIFIC AREA LENGTH OF MODIFIABLE AREA	
.DEVICE SPECIFIC CONTENTS MODIFIABLE AREA		Char(N)					
- Length of local LUNAME - Local LUNAME - Length of remote LUNAME - Remote LUNAME - SESSION LIMIT FOR THIS LUNAME - LOCAL CONTENTION-WINNER SESSION LIMIT FOR THIS		Bin(2) Char(8) Bin(2) Char(8) Bin(2) Bin(2)				MAXIMUM NUMBER of SNA Sessions for THIS LU MAXIMUM NUMBER of Local Contention-Winner sessions for this LU	'0001'X-'0008'X LOCAL LUNAME -All Zeros and length='0008'X: USE LOCAL SYSTEM NAME '0001'X-'0008'X REMOTE LUNAME '0000'X-'01FC'X '0000'X-'00FE'X

ELEMENTS CONTAINED IN LUD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
LUNAME - NUMBER OF MODE ENTRIES IN USE		Bin(2)				Number of mode entries actually being used	'0000'X - TOTAL NO. OF MODE ENTRIES
..Repeat for EACH MODE							
. SERVICES MODEL	Char(26)						
-MODENAME LENGTH		Bin(2)					'0001'X-'0008'X
-MODENAME		Char(8)					
-MAX NUMBER OF CONVERSATIONS THIS MODE		Bin(2)				MAXIMUM NUMBER OF CONVERSATIONS FOR THIS MODE (NOTE:SUM OF CONVERSATIONS FOR ALL MODES CAN NOT EXCEED MAXIMUM CONVERSATIONS FOR THIS LU)	'0001'X-'0200'X
-MAXIMUM SESSION COUNT		Bin(2)				MAXIMUM SESSION VALUE TO BE USED BY VMC WHEN LUD IS IN VARIED-ON STATE	'0000'X-'01FA'X
-MAX NUMBER Local Contention-Winner SESSIONS		Bin(2)				CURRENT MAXIMUM NUMBER OF LOCAL CON- TENTION-WINNER SESSIONS for this Modename	'0000'X-'00FD'X
-MAX PREBOUND SESSIONS		Bin(2)				NUMBER OF SNA Sessions to be Bound at Initialize time	'0000'X-'00FD'X
							-NON-ZERO EQUALS PREBIND VALUE -ZERO EQUALS NO PREBIND VALUE
-PREBIND INDICATOR (CNOS Negotiation Indicator)		Char(1)					'00'X LATE PREBIND AT REQIO CNOS (Model Negotia- tion) '01'X EARLY PREBIND AT MODLUD ACT (No Model Nego- tiation)
							'00'X NOT A RESERVED MODENAME '01'X THIS IS THE RESERVED MODENAME FOR THIS LUD Binary zeros
-RESERVED MODENAME INDICATOR		Char(1)					
-RESERVED		Char(6)					
. SESSION INFORMATION	Char(6)						
-Inbound Pacing		Bin(2)				DEFINES NUMBER TRANSMAPPCIONS BEFORE a pacing response is needed.	'0000'X TO '003F'X
-Outbound Pacing		Bin(2)				DEFINES NUMBER TRANSMAPPCIONS BEFORE a pacing response is needed.	'0000'X TO '003F'X
-RU buffer Size		Bin(2)				Maximum Request Unit Length	'0100'X or '0200'X
.PRESENTATION SERVICES DATA	Char(36)						
-Access Fields Options		Char(1)				Byte 23 of SNA BIND request	
.PROFILE-ID Indicator		BIT(1)					'0'B - NOT REQUIRED
.PASSWORD Indicator (not required for resrvd modename)		BIT(1)					'1'B - REQUIRED '0'B - NOT REQUIRED
.USER-ID Indicator		BIT(1)					
.Reserved		BIT(5)					'00000'B
-Recovery Options		Char(1)				Byte 24 of SNA BIND request (See PN IFAP for further description)	
.Reserved		BIT(1)					'0'B
.Sync Point Level		BIT(2)					'01'B - COMMIT ONLY
.Restart Capability		BIT(1)					'0'B - NONE
.Reinitiation Option		BIT(2)					'11'B - EITHER PRIMARY OR SECONDARY HALF- SESSION MAY REINITIATE

ELEMENTS CONTAINED IN LUD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
.Session Limit Management		BIT(2)					'00'B - IF SESSION LIMIT FOR THIS LUNAME = 1 IMPLIES SESSION LIMIT = 1 + NO CNOS SUPPORTED)
-Cryptography Options		Char(2)				Cryptography Options	'11'B - IF SESSION LIMIT FOR THIS LUNAME > 1 (IMPLIES SESSION LIMIT > 1 TO CNOS SUPPORTED)
-Cryptography Key		Char(8)				Cryptography key field	Binary zeros
-RESERVED		Char(24)					Binary zeros
.RESERVED	Char(80)						Binary zeros
..END of MODE ENTRY							
.DEVICE SPECIFIC CONTENTS NON-MODIFIABLE AREA		Char(64)					
-MAX NUMBER OF MODE ENTRIES		Bin(2)				MAXIMUM NUMBER OF MODES FOR THIS LU	'0001'X-'0010'X
-RESERVED		Char(62)					Binary zeros

LEGEND OF CRT, MOD, AND MAT KEYS

N - Data fields which are ignored by, not used by, or not applicable to the create, modify, or materialize instructions.

D - Data to be used in creation or modification, or data that can be materialized.

LUD Device Specific Area Materialize Template

ELEMENTS CONTAINED IN THE TEMPLATE	ELEMENT LENGTH	SUB ELEMENT LENGTH
• Device Specific Contents	Char(Y+4)	Current number of conversations Bin(2) Current number of asynchronous conversations Bin(2) Current number of sessions Bin(2) Current number of local contention winner sessions Bin(2) Current number of remote contention winner sessions Bin(2) Maximum number of sessions Bin(2) Maximum number of local contention winner sessions Bin(2) Maximum number of remote contention winner sessions Bin(2) Change number of sessions status Char(1) Reserved Char(61)
- Device Specific Contents Length	Bin(2)	
- Device Specific Contents Modify Length	Bin(2)	
- Device Specific Parameters	Char(N)	
• Length of local LU name	Bin(2)	
• Local LU name	Char(8)	
• Length of remote LU name	Bin(2)	
• Remote LU name	Char(8)	
• Session limit for this LU (all sessions)	Bin(2)	
• Local Contention-Winner Session limit for this LU	Bin(2)	
• Number of modes in use	Bin(2)	
• Mode Entry definition	Char(148X)	
Mode Entry Definition Data---contains a value 148X where X is the number of Mode Entry Data areas in the following list.		
Services Model Information	Char(26)	• Device Specific Contents(Non-modifyable) Char(66)
Length of modename	Bin(2)	
Modename	Char(8)	Maximum number of mode entries Bin(2) Total number of sessions Bin(2) Total number of asynchronous conversations Bin(2) Total number of synchronous conversations Bin(2) Length of local LU name Bin(2) Local LU name Char(8) Length of remote LU name Bin(2) Remote LU name Char(8) Length of fully qualified PLU name Bin(2) Length of fully qualified SLU name Bin(2) Fully qualified PLU name Char(17) Fully qualified SLU name Char(17)
Maximum number of CCBS for this mode	Bin(2)	
Initial Local Maximum Sessions	Bin(2)	
Maximum Number Local Contention-Winner Sessions	Bin(2)	
Maximum Number Prebound Sessions	Bin(2)	
Prebind indicator (CNOS Negotiation Indicator)	Char(1)	
Reserved modename indicator	Char(1)	
Reserved	Char(6)	
Session Information	Char(6)	Conversation Finite States Char(2Z)
Inbound pacing	Bin(2)	
Outbound pacing	Bin(2)	
RU buffer size	Bin(2)	
Presentation Services Data	Char(36)	Conversation Finite States---contains a value 2Z where Z is the total number of conversations (sum of effective maximum conversations for each mode entry plus one attach manager conversation per mode entry) Conversation Finite States Char(2)
Access Fields Options	Char(1)	
Recovery Options	Char(1)	
Cryptography Options	Char(2)	
Cryptography Key	Char(8)	
Reserved	Char(24)	
Materialize-only fields	Char(80)	
Effective maximum number of CCBS	Bin(2)	

LUD Device Specific Area Materialize Template

ELEMENTS CONTAINED IN THE TEMPLATE		ELEMENT	SUB ELEMENT	LENGTH	LENGTH
Conversation	operational	mode			
Bit(2)					
00 = Deallocated					
01 = Synchronous					
10 = Deallocated/HSCB Connected					
11 = Asynchronous					
Error	recovery	mode			
Bit(1)					
0 = Normal					
1 = Inoperative					
Source	or	target	conversation		
Bit(1)					
0 = Source					
1 = Target					
Output	pending	on	conversation		
Bit(1)					
0 = No output pending					
1 = Output pending					
Dummy		conversation			
Bit(1)					
1 = Dummy conversation					
Temporary		conversation			
Bit(1)					
1 = Temporary conversation					
Reserved					
Bit(9)					

5.7.3 LU SERVICES INSTRUCTION SUPPORT

Communication with a remote PU is accomplished through SNA paths. The MSCP-LU path is activated when the LUD is varied on. An LU-LU path is activated when a +RSP to BIND is received or sent. To manage these SNA paths the following MI commands are supported.

- MODND:
 - Vary On/Off
 - Enable/Disable
 - Manual Answer/Abandon Call
 - Manual Start Data
 - Cancel
 - Continue
- MODCD:
 - Vary On/Off
 - Dial/Abandon Connection
 - Cancel
 - Continue
- MODLUD:
 - Vary On/Off
 - Activate/Deactivate
 - Reset
 - Cancel
 - Continue
- MATND:
 - Materialize ND Template values based on selected OPTIONS.

- MATCD:
 - Materialize CD Template values based on selected OPTIONS.
- MATLUD:
 - Materialize LUD Template values based on selected OPTIONS.

Prior to using any of these commands, the user must create the network describing the line-ND, the remote PUs-CD, and the LUs-LUD. This is done by using the following MI support code instructions:

- CRTND - Create Network Descriptor
- CRTCD - Create Controller Descriptor
- CRTLUD - Create Logical Unit Descriptor

See the instruction sections for the template data needed to create the NDs, CDs and LUDs for the supported remote PUs or LUs.

MODND (VARY ON/OFF)

These commands are used to activate or deactivate the primary or secondary communications line. When the attachment for a leased line is activated, the line is prepared for transmitting to the attached PUs. When the attachment is for a switched network the connection can be established in one of two ways:

- Dial In
- Dial OUT

For both the Dial In and Dial Out cases, the CD Contact Successful event(Section 5.7.6) is signaled upon completion of the activity. Also, the forward and backward switched connection pointer in the ND and CD are updated to complete the addressing chain.

MODND (ENABLE/DISABLE)

These commands are used on switched communications lines to actually enable (allow) or disable (deactivate) the line to accept or reject incoming calls, outgoing calls or calls in either direction based on the setting of the switched connection method field in the ND.

MODND (MANUAL ANSWER/ABANDON CALL)

These commands are used to synchronize the hardware adapter signals with operator actions for completing or discontinuing a switched manual answer connection. Specifically, the MODND (Manual Answer) command indicates that the operator has established the connection and causes the MSCP to initialize the line.

MODND (START DATA)

This command indicates that the operator has manually placed the coupler in Data Mode, and the line is now ready for Data Communications.

MODND (CANCEL)

This instruction is used to suspend the reconnection and reuse of the communication line.

MODND (CONTINUE)

This instruction is used to enable (allow) the reuse of the line after an unrecoverable error has occurred.

MODCD (VARY ON/OFF)

This command is used to establish or break the communications path from the MSCP to the remote PU.

MODCD (DIAL/ABANDON CONNECTION)

This command is used to allow a remote PU to be dialed manually or automatically or to be disconnected.

The MODCD (Abandon Connection) command will cause the switched connection to be broken. The instruction is allowed to be issued and completes whenever the CD Recovery Activation status does not indicate Active. However, during the asynchronous processing being done by the MSCP a +RSP Bind being sent or received for any attached LUD would normally move the CD status to active and the Abandon Connection would fail. However, when this condition occurs during the asynchronous processing of the Abandon Connection the session(s) will be Unbound, synchronous transactions marked in error state, forcing a Deallocate, and the connection dropped. This command does not place the LU-LU path in an inactive state for any of the attached LUDs that indicate the ACTIVE SESSION state and WILL NOT:

- Cause the Activate Resource REQIOs to be returned to the user's return queue.
- Cause a state transition for any of the attached LUDs that indicate the RESET, QUIESCED, SUSPENDED or ACTIVE SESSION state. This is due to the operational characteristics of the Communications Recovery - Interconnected Systems support that allows asynchronous transaction programs to process data without having an SNA session allocated or the need for a connection to be established. This then would not allow the LUD state transition to VARIED ON PENDING, the LUD would remain in the ACTIVE SESSION state and the MODIFY CD instruction would complete successfully to allow asynchronous transactions to continue. The Synchronous transactions will be marked in error state, thus, forcing a DEALLOCATE when all data is processed.

MODCD (CANCEL)

This instruction is used to suspend the reconnection and reuse of the controller.

MODCD (CONTINUE)

This instruction is used to enable (allow) the reuse of the controller and request that contact be established after an unrecoverable error has occurred.

MODLUD (VARY ON/OFF)

This command is used to make the LUD available for establishing the communications path from the MSCP to the LU.

This command will cause all Activate Resources to be returned. (NOTE: MODLUD DEACTIVATE MUST OCCUR PRIOR TO MODLUD(VARY OFF))

MODLUD (ACTIVATE/DEACTIVATE)

This command is used to deactivate the LU-LU path and is also used to activate the LU-LU path when it is in any one of the four inactive states (Suspended, Quiesced, Reset or Varied On).

The MODLUD (Activate) Command will cause the MSCP to initiate the processing to establish the SNA Session resource. Refer to Section- 5.3.4 which describes the processing required to accomplish this.

The MODLUD (Deactivate) command causes the LU-LU path and LU-LU Session to be placed in an inactive state with all data being purged for all active (allocated) Conversations and sends a -RSP for all pending Attach (Program Start) and Bind requests. This command causes all REQIOs (except Activate Resources) for all conversations (includes the Attach Manager Conversation) to be flushed back to the user's return queue with a feedback status indicating the flushed condition and the number of request descriptors processed are set in the feedback record. When the necessary synchronization is completed the Conversation IDs are deallocated and the LUD state is set to VARIED ON. The active (BOUND) SNA sessions are UNBOUND without using the CHANGE NUMBER OF SESSIONS, BIS, or send error (FMH7) protocols to terminate these sessions orderly. It is expected that the MI user will reinstate the sessions via a MODLUD (Activate) command or Vary Off the LUD. If the Deactivate Resource REQIO is issued after the MODIFY LUD Deactivate command is processed, it will complete with normal FBR status.

MODLUD (RESET)

This command causes all REQIOs (except Activate Resources) for all conversations (includes the Attach Manager Conversation) to be flushed back to the user's return queue with a feedback status indicating the flushed condition and the number of request descriptors processed are set in the feedback record. This command places the path in an

inactive state, which can be reactivated with a MODLUD (Activate) command.

The Reset command will discard data and sends a -RSP for all pending Attach (Program Start) requests. The MI User must be aware that REQIOs maybe returned with only part of the data transmitted. This situation could cause the next operation to encounter DFC STATE errors(I.E. The RESET of a transmit operation may leave DFC STATES in an intermediate state,therefore, the next operation may encounter a STATE reject.).

MODLUD (QUIESCE)

This command is not implemented in LU6.2 and will always cpmplete with a rejected status indicating timeout. Therefore, the MI User should issue MODLUD (Reset,Deactivate).

MODLUD (CANCEL)

This instruction is used to suspend the device after an unrecoverable error.

MODLUD (CONTINUE)

This instruction is used to enable (allow) the reuse of the device after an unrecoverable error has occurred.

5.7.4 LU SERVICES RECOVERY INSTRUCTIONS

Refer to the communications recovery chapter for discussion of the use of the MODIFY (continue and cancel) functions. See section 5.3.

5.7.5 LU SERVICES FUNCTIONS

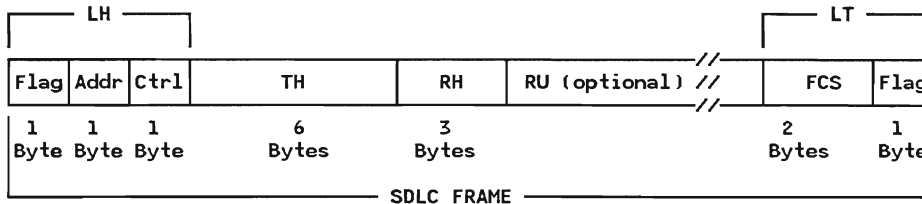
5.7.5.1 SDLC Support

Both Primary and Secondary SDLC are supported using the following commands and responses:

Commands	Responses
XID	XID
TEST	TEST
SNRM	UA
DISC	DM
RR	RR
RNR	RNR
I	I
	FRMR
	RD

The descriptions of these commands and responses and their use by S/38 APPC are in the following section.

SDLC I-FRAME STRUCTURE



LH = LINK HEADER

- * Flag Byte (Hex 7E)
Unique byte that denotes the beginning and end of a frame. The same flag may indicate the end of a frame and the beginning of the next frame.
- * Address Byte
Contains the address of the Controller.
- * Control Byte
Denotes the type of frame and the receive and transmit count (count (N(r)), N(s)).

TH = TRANSMAPPCION HEADER

- * Address information for FID2 path control PU.T2.

RH = REQUEST HEADER

- * Control information needed by transmission control to route messages to NAUs.

RU = REQUEST/RESPONSE UNIT

- * Contains the source/sink request (length of RU depends on hardware involved, max of 512).

LT = LINK TRAILER

- * Frame check sequence (FCS).
- * Flag byte (Hex 7E).

Station Address

The address field is limited to one byte; all ones signify the broadcast (all stations) address, and all zeros the null (no stations) address. All other addresses are unique. S/38 does not support group addressing (one address common to more than one station on the link).

Modes

S/38 secondary operates in either Normal Response Mode (NRM) or Normal Disconnect Mode (NDM). NRM is the operational mode for information exchange, entered upon acceptance of a Set Normal Response Mode command. NDM is the mode assumed following receipt of a Disconnect command, when being activated, or in case of malfunction or reset. None of the Asynchronous modes (ABM, ARM, ADM) is supported, nor is Initialization mode.

The following table describes commands and responses supported by S/38 APPC secondary. Acceptance of these commands is dependent upon the mode and status of the secondary station, as follows:

Mode	Status	Commands Accepted	Responses Sent
NDM	--	XID	XID, RD
		TEST	TEST
		SNRM	UA, DM, RD
		DISC	DM
NRM	CMD REJ EXCEPTION	SNRM	UA
		DISC	UA
		-	FRMR
		-	RD
NRM	NO EXCEPTION	XID	XID
		TEST	TEST
		SNRM	UA
		DISC	UA
		RR	I, RR, RNR
		RNR	RR, RNR
		I	I, RR, RNR
		-	RD

Information Commands/Responses

Information (I) frames are used for information transfer. When I-frames are received, S/38 checks the Nr and Ns counts. If the counts are correct, S/38 confirms by returning an Nr count = Ns+1 (modulo 8). If the Ns count does not match, S/38 requests retransmission via the returned Nr count; if the Nr count does not match, S/38 retransmits beginning with frame Nr+1(modulo 8).

Unnumbered Commands/Responses

The following unnumbered commands are transmitted by S/38 primary and supported by S/38 secondary:

- **Set Normal Response Mode (SNRM)** - This command asks S/38 secondary to enter Normal Response Mode (NRM). For APPC, S/38 secondary transmits a Disconnect Mode (DM) response if the local CD has not (yet) been contacted. If the CD is contacted, S/38 secondary transmits an Unnumbered Acknowledgement (UA) response to the primary, resets the station sequence counts (Nr and Ns) to zero, and the acknowledgement of any I-frames received but not yet acknowledged is inhibited. S/38 primary transmits another SNRM after a three-second interval if it receives a DM response to the SNRM.

- **Disconnect (DISC)** - This command places S/38 secondary in Normal Disconnect Mode (NDM), and if in NRM causes it to transmit a Unnumbered Acknowledge (UA) response to the primary. If the secondary station is operating on a switched line, it will go on-hook. If in NDM, S/38 secondary will respond with DM.
- **Exchange Station Identification (XID)** - This command is sent by S/38 primary to obtain the identification of the secondary station. When this command is accepted by S/38 secondary, the response is an XID frame which contains the secondary station identification as the I-field. The format of this field is defined in AWP125-05. The S/38 will not negotiate XIDs; however, it will accept an XID indicating negotiation. The S/38 will configure objects to determine Primary/Secondary roles, Assignor-ID, and BIND race winner.
- **Test (TEST)** - This command is sent by S/38 primary in support of the SDLC link test function. When S/38 secondary accepts this command, it returns a TEST response. The I-field of the response will contain the data from the I-field (if any) in the TEST command.

The following unnumbered responses are transmitted by S/38 secondary and supported by S/38 primary:

- **Unnumbered Acknowledge (UA)** - See SNRM and DISC commands above.
- **Disconnected Mode (DM)** - This response is transmitted only when S/38 secondary is in Normal Disconnect Mode (NDM), and in this mode is the only response transmitted, with the following exceptions:
 - UA is returned if SNRM is received and the CD is contacted (see SNRM command above)
 - XID is returned if XID is received
 - TEST is returned if TEST is received
- **Exchange Station Identification (XID)** - See XID command above.
- **Test (TEST)** - See TEST command above.
- **Frame Reject (FRMR)** - This response is returned only in Normal Response Mode (NRM) when S/38 secondary detects a problem in a frame received with good FCS. FRMR will be transmitted at every response opportunity until an SNRM or DISC command is received. The FRMR response contains an information field which specifies the reason for the response.
- **Request Disconnect (RD)** - This response is used by S/38 secondary to request to be put into disconnect mode via a Disconnect (DISC) command from the primary. On receipt of the RD response, S/38 primary will send a DISC command.

Supervisory Commands/Responses

The following supervisory commands/responses are supported by S/38 APPC:

- Receive Ready (RR) - This frame is used to acknowledge I-frames received with Ns counts through Nr-1 (modulo 8) (specified in bits 0-2 of the RR control byte), and to specify that the station is ready to receive additional I-frames.
- Receive Not Ready (RNR) - This frame is used by to acknowledge I-frames received with Ns counts through Nr-1 (modulo 8) (specified in bits 0-2 of the RNR control byte) and to specify that the station cannot receive additional I-frames at this time.

After receiving an RNR frame, S/38 establishes a busy condition for the far end station which is not reset until receipt of an SNRM, DISC, I, or RR frame. Similarly, S/38 reports clearing a previously reported not ready to receive condition by transmitting an I or RR frame with the poll/final bit on.

If S/38 secondary receives an SNRM or DISC command while in the busy state, it responds with UA, which causes the primary to reset the established busy condition for S/38 secondary. If the busy condition still exists, S/38 secondary will reestablish it via the RNR response at its next appropriate response opportunity.

Timer Considerations

On an SDLC data link, S/38 primary uses two timeouts, the idle detect and nonproductive receive, to check for responses to its commands. S/38 secondary has implemented at the IOC level a nonproductive receive or inactivity timer for switched line operation to detect unintelligible transmissions or lack of transmission from the primary when one is expected.

The idle detect timer is specified in the Communications Subsystem parameters in the Network Descriptor for S/38 APPC primary. Typical values are in the range of 400-800 ms. The timeout value is the sum of the following:

- RTS-CTS modem delay
- 2-way line propagation delay
- Secondary station response time

The S/38 secondary response time has not been determined but will be available for a later version of this document.

The non-productive receive timer in S/38 primary operates on both switched and non-switched lines. Its purpose is to monitor for non-productive receive conditions. The duration of the timer is specified in the Communications Subsystem Parameters in the Network Descriptor, and should be in the range of 3 to 20 seconds. Refer to Section 3.3.1, Communications Line Configuration, for specific information on appropriate values for this timer.

The nonproductive receive timer in S/38 secondary operates only on a switched line and is known as the switched line inactivity timer. Its purpose is to monitor for line inactivity or nonproductive receive conditions. The duration of the timer is specified in the Communications Subsystem Parameters in the Network Descriptor. It should be set to 30 seconds for normal operation; special circumstances or debug conditions may require a different value.

For S/38 secondary, the switched line inactivity timer expiration indicates an error in either the primary station, a DCE or other hardware component, or the link itself. S/38 secondary's action upon timeout is determined by the Selectable Modes in the Network Descriptor. Under normal operation, the ND will be set to cause switched line disconnection by the IOC; special circumstances or debug conditions may require that the line not be disconnected.

5.7.5.2 SNA Support

SNA GENERAL SUPPORT

- Physical Unit Type 2.1 - to - Physical Unit Type 2.1
- Physical Unit type 2.1 to physical unit type T4/T5 (not full support, single session to CICS only).
- MULTIPLE LUS ON ONE PHYSICAL LINK, WHICH ARE LU TYPE C (AWP128) AND LU1 IN ANY COMBINATION RUNNING UNDER THE SAME VMC TASK. THE LU-C SUPPORT CAN COEXIST WITH THE 5250 support on a Multi-drop link. The details of the 5250 support is documented in the MI IV for the Primary Station IOM. THE LU-C SUPPORT CAN ALSO COEXIST WITH THE LU1 SUPPORT ON A SECONDARY LINK. THE DETAILS OF THE LU1 SUPPORT IS DOCUMENTED IN THE MI IV FOR THE SECONDARY STATION IOM.
- Transmission Profile 7 for LU-LU session
- Function Manager Profile 19 for LU-LU session

FUNCTION MANAGEMENT(FM) PROFILES

FM PROFILE 19 specifies the following rule:

- Multiple RU chains allowed.
- PRIMARY AND SECONDARY LU HALF-SESSIONS USE IMMEDIATE REQUEST AND RESPONSE MODE.
- Primary and Secondary half-sessions chains may indicate definite or exception response.
- No compression.
- Brackets are used.
- Primary and Secondary half-sessions may send EB(CEB).
- FM headers are allowed.

- Conditional termination for brackets will be used.
- No alternate code.
- Normal-flow send/receive mode is half-duplex flip-flop.
- Symetric responsibility for recovery.
- Primary and Secondary LU half-sessions suport the following DFC functions:
 - SIGNAL
 - LUSTAT
 - BIS
 - RTR
- The FM Usage fields defining the options for Profile 19 are:
 - Request control mode selection (primary and secondary)
 - Brackets reset state
 - Contention winner/loser
 - Half-duplex flip-flop reset states.

FM PROFILE VS. TYPE OF SESSION

- The follwing table specifies which FM profiles may be used with each type of session.

FM PROFILE	TYPE OF SESSION		
	(SSCP, PU)	(SSCP, LU)	(LU,LU)
0	yes	yes	no
19	no	no	yes

TRANSMAPPCION SERVICES(TS) PROFILES

This section describes the transmission services(TS) profiles and their use for the various sessions within a peripheral node.

NOTE: If the TS useage field specifies a value for a parameter , that value is used unless it conflicts with a value specified by the TS profile. The TS profile overrides the TS useage field.

TS Profile 7 specifies the following rules:

- Primary-to-secondary and secondary-to-primary normal flows are paced.
- Sequence numbers are used on the normal flows (whenever the TH format used includes a sequence number field).

- SDT,CLEAR,RQR,STSN ,and CRV are not supported.
- The TS useage subfields defining the options for this profile are:
 - Pacing counts.
 - Maximum RU sizes on the normal flows

TS PROFILE VS. TYPE OF SESSION

- The follwing table specifies which TS profiles may be used with each type of session.

TS PROFILE	TYPE OF SESSION		
	(SSCP, PU)	(SSCP, LU)	(LU,LU)
1	yes	yes	no
7	no	no	yes

PHYSICAL UNIT (PU) TYPES

The PU type 2 is the only defined PU type for a peripherral node.

For all PIUs sent to and received from a PU-T2 node, the transmission header(TH) format is FID2.

5.7.6 LU SERVICES REQIO SUPPORT

Prior to using the LU SERVICES REQIO command, the user must do the following:

- Perform CRTLIND to establish the Line Description(ND).
- Perform CRTCUD to establish the Controller Description(CUD).
- Perform CRTDEV D to establish the Logical Unit Description(LUD).
- Perform MODND to Vary On the Line Description(ND).
- Perform MODCTLU to Vary On the Controller Description(CUD).
- Perform MODLUD to Vary On the Logical Unit Description(LUD).
- Perform Supervisory Services REQIO to Activate Resource.

5.7.6.1 REQIO

The MI process that issues Conversation requests must communicate with the APPCIOM via the REQIO

instruction. The LU-LU session is accessible to the MI process by using the NORMAL REQIO with the SSR object pointer addressing the appropriate LUD and Conversation.

This command is used for two purposes:

- First, it is used to perform the normal functions on the Logical Unit-To-Logical Unit flow. These normal functions include:
 - SYNCPT
 - SEND-DATA
 - PREPARE-TO-RECEIVE
 - REQUEST-WRITE
 - SEND-RESPONSE
 - RECEIVE
 - WAIT-ON-RESOURCE
 - POST-ON-RECEIPT
- Second, the REQIO (continue) is used to return the logical unit to active path state after it has encountered a terminating error.

Refer to the Request I/O instruction for details on the REQIO command and its Source/Sink Request (SSR) object.

General REQIO Rules

REQIO (Normal)

- Request Descriptors (RD)
 - A REQIO (normal) may contain all transmit Rds.
 - A REQIO (normal) may contain all receive Rds.
 - A REQIO (normal) may contain both transmit and receive Rds. All transmit Rds must occur prior to the receive Rds.
 - The write-up on Rds contain the detailed field description and usage.

SNA Flow: The SNA Flow for a REQIO (normal) may be expedited, normal, or any. This is indicated in the SSR as defined later in this text.

REQIO (Receive Immediate)

- Request Descriptor (RD)
 - A REQIO (Receive Immediate) is indicated by the RD being a receive with the immediate bit set on.
 - A REQIO (receive immediate) may contain only receive Rds.
 - The write up on RDs contains the detailed field descriptions and usage.

SNA Flow: The SNA Flow for a REQIO (Receive Immediate) may be expedited, normal or any. This is indicated in the SSR as defined later in this text.

REQIO (Transmit Immediate)

Request Descriptor (RD)

- A REQIO (Transmit Immediate) contains only one RD which is encoded as a transmit immediate RD.
- A REQIO (Transmit Immediate) will be processed prior to any SNA normal flow transmit that is already queued up for a LUD.

SNA Flow: The SNA flow for a REQIO (Transmit Immediate) may be expedited or Normal. This is indicated in the SSR as defined later in this text.

Note: A REQIO Transmit or transmit/receive on the ANY flow defaults to a REQIO transmit only on the normal flow.

5.7.6.2 IOM Source/Sink Request (SSR) General

The SSR defines the type of REQIO function to be performed, certain control, identification, sequencing functions, and the set of operational orders or commands for the APPC support.

The SSR must contain a system pointer to a LUD representing the LU, A MODENAME SELECTING THE SNA SESSION GROUP, optionally a conversation-id SELECTING THE CONVERSATION AND/OR SESSION, A SYSTEM POINTER TO AN MI RESPONSE QUEUE FOR ROUTING THE MESSAGE BACK TO THE USER CONVERSATION, AND OPTIONALLY A SPACE POINTER TO THE DATA IN THE SSD. THE control field in the SSR is used to identify the REQIO as being directed to the APPCIOM (Normal) or APPCIOM (Resource Manager).

The layout for the SSR and the fields that are new to APPC follow:

Contents of the SOURCE/SINK Request (SSR)

Field Name	Length	Notes
Template Size Specification - Size of Template - Number of Materializable bytes	CHAR(8) Bin (4) Bin (4)	
Request I/O Timeout	CHAR(8)	3
Source/Sink Object	System Ptr	
Response Queue	System Ptr	5
Source/Sink Data Area	Space Ptr	6
Optional Ptr Area or (binary zeros)	CHAR(16)	
Reserved (binary zeros)	CHAR(8)	
Request I/O Timestamp	CHAR(8)	
Request Priority	Bin (2)	
Request ID	Bin (2)	5
Function Field	CHAR(1)	
Control Field	CHAR(1)	
Key Length	Bin (2)	5
Offset to Key Field	Bin (2)	5
Request Descriptor Count	Bin (2)	2
Offset to Request Descriptors	Bin (2)	2
Offset to REQIO Variable Parameters	Bin (2)	

All storage must be allocated for each REQIO. All fields must be specified, except as noted:

Contents of the SOURCE/SINK Request (SSR): VARIABLE DATA:

Field Name	Length	
Length of Variable Area	Bin(4)	
Reserved	CHAR(28)	
Conversation-ID	CHAR(16) ZEROS=NULL	1
Reserved (binary zero	CHAR(8)	
MODENAME LENGTH	Bin(2) ZEROS=ALL MODES	4
Reserved (binary zero	CHAR(6)	
MODENAME	CHAR(8) ZEROS=DEFAULT MODE	4
Reserved (binary zeros)	CHAR(40)	

Note 1: Not required for Change Number of Sessions.

Note 2: Not required for Continue (RD Count and offset may be 0).

Note 3: Not required for Normal, Continue, asynchronous Resource Manager Requests, and synchronous REQIO's without task switching.

Note 4: Not required for Normal and Continue requests.

Note 5: Not required for Synchronous requests.

Note 6: Not required for Test and Quiesce or REQUEST-WRITE subcommands,

The following fields have special meaning to APPC:

The CONTROL FIELD is used to denote the type of REQIO to the Machine. The following values are defined:

- Character 'N' REQIO is a Normal request (Default Operations, Request-Write, Send-Response).
- Character 'C' REQIO is used to perform Continue.
- Hex '10' REQIO is an ASYNCHRONOUS Resource Manager request. (Change Number of Sessions, Get Sessions, Test and Quiesce.)
- Hex '20' REQIO is a SYNCHRONOUS Resource Manager request. (Conversation Reset)

The SYSTEM POINTER to a LUD specifies the LUNAME to which the message is directed. The LUD must be in the ACTIVE SESSION STATE prior to issuing any IOM Asynchronous or Synchronous REQIOs (X'8' specified in bits 0-3 of the Function Field). The system will place the LUD in the VARIED ON state as soon as the contact is made with the Remote PU and in the ACTIVE SESSION STATE as soon as the MODLUD(ACTIVATE) completes.

The MI RESPONSE QUEUE pointer provides the APPCIOM with the necessary information for performing the data routing (i.e. The Path for delivering the data to the correct Conversation Process).

The Request I/O Timeout is used to time the Synchronous REQIO operations. THIS FIELD IS ONLY SPECIFIED FOR SYNCHRONOUS REQIOS.

The CONVERSATION-ID is used as the ACCESS KEY to the Conversation and its resources. This field is in the SSR Variable Data area. It is addressed through the REQIO VARIABLE PARMS offset field in the SSR main body.

The layout for the CONVERSATION-ID follows:

0 - 7 8 - 11 12 - 13 14 15

UNIQUE KEY	RESERVED	CCB INDEX	MODE INDEX	LU INDEX
------------	----------	-----------	------------	----------

- UNIQUE KEY: The KEY is used to identify uniquely ownership of this Conversation. It is assigned by the MI User for Activate Resource Requests. For all other APPC REQIOs (except Change Number Of Sessions and Test And Quiesce, which do not require a Conversation ID), the MI User must use the value returned by the machine either for an Activate Resource Request or for a REQIO on the Attach Manager Conversation which returned an FMH-5 Attach.
- CCB INDEX: The CCB INDEX is used to locate the Conversation. Its value will be in the range 1 to M+N, where M is the maximum number of conversations for the Mode Entry and N is the number of MODES in the LUD.

- MODE INDEX: The MODE INDEX is used to locate the MODE ENTRY. Its value will be in the range 1 to N, where N is the number of MODES in the LUD.

- LU INDEX: The LU INDEX is used to locate the LU ENTRY. Its value will be 1 - P, where P is the number of LUDS attached to the CD.

MODENAME LENGTH specifies the number of characters (left-justified) used in the modename field. A value of zero specifies that the request (e.g. Change Number Of Sessions) applies to all modenames in the LUD.

The MODENAME is used to select the MODE (CLASS OF SERVICE) desired. If this field is NULL (i.e. binary zeros) the machine will select the first MODE defined in the VMC portion of the LUD. A MODENAME value of blank (X'40') is a valid MODENAME.

The pointer to the SSD Space provides addressability to the optional input or output data buffers as required by the RD fields in the SSR.

The offset to REQIO VARIABLE PARAMETERS is set only when the VARIABLE PARAMETERS are used (I.E PEER I/O) otherwise, it is zero. This offset is from the beginning of the REQIO SSR TEMPLATE.

The SSR function bits have the following meanings for device management:

Bits 0-3 Same as defined in the Request I/O instruction.

Bits 4-5 These bits are used only for Normal Requests (CONTROL FIELD = 'N') and define the SNA flow on which all the Request Descriptors (RDs) are to be processed. The values and their meanings are:

00 and 10 - These combinations indicate that the RDs are to flow on the SNA normal flow.

01 - This combination indicates that the RDs are to flow on the SNA expedited flow.

11 - This combination indicates that the RDs are to flow on either the SNA expedited or normal flow (ie, it implements a receive any function).

Note: This bit setting is changed to '10'B (normal flow) if the first RD is a transmit RD.

Bits 6-7 Reserved (binary zero)

SSD formats are specified in the sections describing the individual REQIO's.

5.7.6.3 IOM Asynchronous Request Descriptor(RD)

0	1	2	3	4-5	6-7	8-10	11	12-15
---	---	---	---	-----	-----	------	----	-------

Where:

- 0 = RU Flow Type
- 1 = Ideographic field
- 2 = Request DESCRIPTOR Subcommand
- 3 = Test & Quiesce Condition
- 4-5 = Seq #
- 6-7 = RU Length
- 8-10 = Request RESPONSE Header
- 11 = Reserved (Unused)
- 12-15 = RU Offset

Request/Response Unit Flow Type = Char(1):

- Bit 0 of the RU flow type indicates whether this is a transmit or receive RD

- Bit 0 = 0 Transmit RD
- Bit 0 = 1 Receive RD

This bit is ignored by the Synchronous and Asynchronous Resource Manager Request processing.

- Bit 1 indicates whether the RD has been processed by the machine or is awaiting processing.

The APPC management ensures that this bit is set to zero upon receipt of the REQIO. This bit may not be used by the user to cause the APPC management to skip the RD. The APPC management always assumes that all the RDs in the REQIO are to be processed.

In a terminating or non-terminating error situation, the RD completion count will point to the RD on which the error was discovered. This RD will be marked processed.

The values are:

- Bit 1 = This bit indicates the completion status of this RD.
 - 0-not processed
 - 1-processed
- Bits 2 and 3 are reserved and must be binary zero.
- Bit 4 = This bit means transmit or receive immediate depending on the setting of bit 0.

- 0-Normal I/O operation
- 1-Immediate I/O operation

- Bits 5-7 are reserved and must be binary zero

IDEOGRAPHIC FIELD = CHAR(1):

- This field is not used by APPC.

REQUEST DESCRIPTOR SUBCOMMANDS = CHAR(1):

- '00'x DEFAULT OPERATIONS: This provides compatibility with current Releases of the Communications Reqios. It will be used for APPC functions such as SEND DATA, RECEIVE, WAIT ON RESOURCE, POST ON RECEIPT, SYNCPT, PREPARE TO RECEIVE, and DETACH.

The LUS Protocol Boundary Functions are described below:

DETACH

- DETACH(CEB):Place the Session resource BETB.
- This is performed at the MI by encoding an RD as a Regular or Immediate Transmit.
- The DETACH will be indicated by the CEB bit in the Request Header.

POST-ON-RECEIPT

- POST the specified RESOURCE when there is data to receive.
- The SSR is encoded to have the REQIO COMPLETE EVENT signaled when the operation is complete.
- This is performed at the MI by encoding an RD as a REGULAR or IMMEDIATE RECEIVE.
- The Response Header will be set to report the current functions received.
- The received data is placed in the SSD at the specified offset.
- This operation is mapped to a Receive by the Machine when the Conversation Resource is asynchronous.
- The MI USER invokes an Event Monitor to field the REQIO COMPLETE EVENT.

PREPARE-TO-RECEIVE

- Give control of data flow to the remote program.
- This is performed at the MI by encoding an RD as a Regular or Immediate TRANSMIT.
- The Request Header bit CDI (Change Direction) is set on.

RECEIVE

- Receives data from a remote program.
- If nothing is available, the Feedback code will indicate NO-DATA.
- This is performed at the MI by encoding an RD as an IMMEDIATE RECEIVE.
- The Response Header will be set to report the current functions received.
- The received data is placed in the SSD at the specified offset.
- The MI USER issues a DEQUEUE to receive the Feedback Record.

NOTE: When this operation is issued for the Attach Manager Conversation IDs, the operation is restricted to Receive only RDs. The format of the SSD returned to the user is:

<u>Field</u>	<u>Length (bytes)</u>
FMH-5 (Attach)	specified in first byte
Conversation ID	16
Decoded Local Max RU Size (Send)	4
Decoded Remote Max RU Size (Rcv)	4
Session Polarity	2
'0000'x = Contention-winner	
'0001'x = Contention-loser	
Bind Image Length	2
Bind Image	N

SEND-DATA

- Send data to a remote program.
- This is performed at the MI by encoding an RD as a Regular or Immediate TRANSMIT.

SEND-EVOKE

- Initiates a Transaction Program at the Remote LU.
- This is performed at the MI by encoding an RD as a REGULAR TRANSMIT.
- The Request Header bit FI(Format Indicator) is set on.
- The FMH5 is in the SSD.

SYNCPT

- Take a sync point of all resources allocated to specified Conversation.
- This is performed at the MI by encoding an RD as a Regular or Immediate Transmit.
- The SYNCPT will be indicated by the DR2 bit in the Request Header.

WAIT-ON-RESOURCE

- Receives data from a remote program.
- Waits for the data to arrive before completion.
- This is performed at the MI by encoding an RD as a REGULAR RECEIVE.
- The Response Header will be set to report the current functions received.
- The received data is placed in the SSD at the specified offset.
- The MI USER issues a DEQUEUE to receive the Feedback Record.
- This operation is mapped to a Receive by the Machine when the Conversation Resource is asynchronous.
- '01'x REQUEST-WRITE: Sends a SIGNAL REQUEST to the remote program. The SSR function field must be set to the Expedited SNA flow.
 - This is performed at the MI by encoding an RD as a Regular or Immediate TRANSMIT.
 - No SSD is required for this subcommand.
- '02'x SEND-RESPONSE: This causes the SNA response to be sent by the Machine. The response sent is either positive or negative based on the setting of the SDI bit in the response header parameters. For a negative response the first 4 bytes of the SSD should contain the sense code. The response RH will be built from the receive correlation table. This subcommand will wait until data is received to respond to and will complete when 1) the response has been sent and the DATA purging is complete or 2) the response has been discarded depending upon DFC State Machines and Protocols being enforced.
 - Informs the remote program that a program error has occurred.
 - This is performed at the MI by encoding an RD as a Regular or Immediate TRANSMIT.
 - This Subcommand will always cause the response sense code set in the SSD to be sent.
 - Encode the RD as a normal transmit.
 - This Subcommand will handle the case where DFC is in Receive state by waiting for data to be received.
 - Set the SDI bit of RD's RH to 1 if sense data (e.g. -RSP) is to be sent.
 - This Subcommand will not send the FMH7. It must be sent using the SEND-DATA interface.
 - This Subcommand will not complete until the received chain has been purged (-RSP only).

- '10'x CHANGE-NUMBER-OF-SESSIONS: This subcommand is used to perform the architected (PN IFAP1 2.96) control functions that involve control of the SNA sessions for this LU,MODENAME. The Change Number of Sessions REQIO specifies the maximum number of sessions allowed. The value specified may increase or decrease the current session values managed by the machine and with the Action value specifies the type of change and which LU is responsible for selection of the sessions to be taken down via the BIS/BIS/UNBIND sequence. Since the command is issued asynchronous to the processing of individual Transaction programs there can be races caused by the machine trying to decrease the number of SNA sessions and the Transaction programs attempt to initiate a Conversation. The solution to these races will be to delay all Activate Resource and Get Session Requests until the selected sessions are unbound. Selection of these SNA sessions by the machine (responsible action value is "LOCAL LU") will occur in the following order:

1. In the BETB state and not allocated to a Conversation.

2. In the BETB state and allocated to a Conversation. (Note: will not be taken down until Deactivate Resource is issued on the Conversation.)

3. In the INB state.

If the immediate bit (RD byte 0 bit 4) = 0, the Machine will not return a feedback record until the specified number of sessions has been reached (SET SESSION LIMITS resulting in a decrease) or until all sessions have been unbound (CLOSE). If the immediate bit = 1, the machine will return a feedback record immediately after saving the new session limits. If a Change Number Of Sessions REQIO is in progress and another Change Number Of Sessions REQIO is received which affects the same modename, the maximum session counts will be replaced by the respective counts in the subsequent request, and the earlier request will be ended with a feedback status of '0015'X.

THE SSD FORMAT FOR THE CHANGE NUMBER OF SESSIONS IS SPECIFIED AS FOLLOWS:

ELEMENTS CONTAINED IN THE SSD	BYTE	BITS	LENGTH	VALUE
LENGTH	0 - 1		Bin(2)	
GDS ID CHANGE NUMBER OF SESSIONS	2 - 3		CHAR(2)	'1210'X
RESERVED	4 - 5		CHAR(2)	'0000'X
ACTION	6		CHAR(1)	
SET SESSION LIMITS				'00'X
CLOSE				'02'X
PREPARE FOR CNOS				'E1'X
CANCEL PREPARE				'E2'X
FORCE UNBIND(CONV)				'F3'X
TERMINATE LOCAL CON WINNER SESSIONS				'F4'X
FOR FORCE UNBIND OPTION:				
UNBIND CODE	7 - 8			'32XX'X
UNBIND SENSE DATA	9 - 12			'XXXXXXXX'X
(USED IF BYTE 8 = 'FE'X)				
FOR CLOSE OPTION:				
DRAIN OPTIONS/RESERVED IF BYTE 6 = 02	7		CHAR(1)	
DRAIN LOCAL LU		0 - 3		
NONE				'0000'B
ALL				'0001'B
DRAIN REMOTE LU		4 - 7		
NONE				'0000'B
ALL				'0001'B
RESPONSIBLE	8		CHAR(1)	
LOCAL LU				'00'X
REMOTE LU				'01'X
MAXIMUM SESSION COUNT	9 - 10		CHAR(2)	
MAXIMUM LOCAL CONWINNERS	11 - 12		CHAR(2)	
MINIMUM REMOTE CONWINNERS	13 - 14		CHAR(2)	

LUNAME -- This selects the LUD that is affected by this CHANGE-NUMBER-OF-SESSIONS command. It is selected by the LUD object pointer placed in the SSR.

ACTION -- This parameter specifies the type of change desired.

- SET-SESSION-LIMITS: Establishes new operating limits for the number and polarity of the Parallel Sessions.

- RESPONSIBLE -- This parameter specifies which LU is responsible for selecting the sessions to be taken down when the session

count is being decreased.

- LOCAL: The LOCAL LU is responsible for selecting and UNBINDing the sessions.
- REMOTE: The REMOTE LU is responsible for selecting and UNBINDing the sessions. (NOTE: The processing done by an LU accepting a CHANGE-NUMBER-OF-SESSIONS command with RESPONSIBLE=REMOTE is exactly the same as if that LU had sent the CHANGE-NUMBER-OF-SESSIONS command with RESPONSIBLE=LOCAL.)
- MAXIMUM SESSION COUNT: This parameter specifies the maximum number of sessions to be allowed between the two LUs on the specified MODENAME.
The value specified must satisfy
MAXIMUM SESSION COUNT >= MAXIMUM
LOCAL CONWINNERS + MINIMUM REMOTE
CONWINNERS.
This value is maintained at both LUs.
The number may be changed (increased or decreased) at any time.
- MAXIMUM LOCAL CONWINNERS: This parameter specifies the maximum number of sessions, of polarity contention-winner for the local LU, which may be active concurrently.
- MINIMUM REMOTE CONWINNERS: This parameter specifies the number of sessions, of polarity contention-winner for the remote LU, which may be active concurrently.
Note: The machine will allow the remote LU to BIND MAXIMUM SESSION COUNT - MAXIMUM LOCAL CONWINNERS contention-winner sessions.
- LENGTH OF MODENAME: Specifies the number of characters used in the field. This length must be in the range of 0 through 8.
- MODENAME: Selects the set of Sessions affected by this ACTION.
Note that blank (X'40') is a valid MODENAME.
- CLOSE: Sets MAXIMUM SESSION COUNT, MAXIMUM LOCAL CONWINNERS, AND MAXIMUM REMOTE CONWINNERS to zero for all affected modenames and causes takedown of all affected sessions via the BIS/BIS/UNBIND sequence, including SNASVCMG and its sessions if implicitly or explicitly specified. Note: If an affected MODENAME is quiesced via the Test And Quiesce subcommand when this action is specified, it will be Unquiesced by the Machine.
- DRAIN OPTIONS: Specify promptness of shutdown as follows:
 - DRAIN LOCAL LU: The LOCAL LU is responsible for selecting and UNBINDing the sessions.
 - NONE: This LU will start NO NEW brackets on any session in this MODE group. The session becomes a candidate for termination as soon as it goes BETB, even if it is allocated to a CONVERSATION.
 - ALL: This LU may start NEW brackets on any session in this MODE group as long as there is a CONVERSATION allocated to that session. When the CONVERSATION is deallocated, the session becomes a candidate for termination.
 - DRAIN REMOTE LU: The REMOTE LU is responsible for selecting and UNBINDing the sessions. (NOTE: The processing done by an LU accepting a CHANGE-NUMBER-OF-SESSIONS command with RESPONSIBLE=REMOTE is exactly the same as if that LU had sent the CHANGE-NUMBER-OF-SESSIONS command with RESPONSIBLE=LOCAL.)
 - NONE: This LU will start NO NEW brackets on any session in this MODE group. The session becomes a candidate for termination as soon as it goes BETB, even if it is allocated to a CONVERSATION.
 - ALL: This LU may start NEW brackets on any session in this MODE group as long as there is a CONVERSATION allocated to that session. When the CONVERSATION is deallocated, the session becomes a candidate for termination.
 - LENGTH OF MODENAME: Specifies the number of characters used in the MODENAME field. This length must be in the range 0 through 8. 0 specifies that the CLOSE operation pertains to all modenames on the LU.
 - MODENAME: Selects the set of Sessions affected by this ACTION.
 - PREPARE FOR CNOS: This option is used to inform the machine that a Change Number Of Sessions negotiation is underway with the remote LUS model. This causes the machine to enqueue incoming BIND requests and Activate Resource and Get Session requests until the SET SESSION LIMITS request is received, at which time the new limits will be used, or CANCEL PREPARE request is received, at which time the existing limits will be used.
 - CANCEL PREPARE: This option is used to nullify the action of the PREPARE FOR CNOS option. Any enqueued BIND requests will be responded to and Activate Resource and Get Sessions requests will be serviced using the existing limits.
 - FORCE UNBIND (CONVERSATION): This option is used to UNBIND the active SNA session from the System 38 LU to the remote CPUs LU and place the

associated Synchronous Conversation in an Asynchronous ERP state where the resource is available only to the LOCAL side. As part of this function the MI USER will receive an error FBR code indicating the FORCE UNBIND and the Session resource will be UNBOUND using the UNBIND code specified in byte 8. If byte 8 = 'FE'x, bytes 9-12 (sense data) will also be used.

- TERMINATE LOCAL SESSIONS: This option is used to terminate all Local Corwiner Sessions via the BIS/BIS/UNBIND sequence for all affected modenames including SNASVCMG if implicitly or explicitly specified. The operation does not change the session limits established by any previous CNOS set limits operation. If a subsequent Activate Resource REQIO is received and no remote corwiner session is available to satisfy the request, a local corwiner session will be bound when the session limits permit it. This may not be possible until a previous session is unbound.

- Length of Modename: Specifies the number of characters used in the modename field. This length must be in the range 0 thru 8. 0 specifies that the operation pertains to all modenames on the LU.

- Bytes 7-14 of the SSD are ignored.

- '11'X GET-SESSION: This subcommand is used to obtain and allocate a session to an asynchronous conversation. The conversation will then become synchronous. The machine will select a session in the following manner:

- A bound BETB con-winner will be selected if available.

- A BID without attach (LUSTAT,BB) will be sent on a BETB con-loser if no BETB con-winner is available. If a positive response is received, the operation will end; if a negative response is received, the search begins again (starting with a BETB conwinner).

- A corwinner will be BOUND if no BETB conwinners or conlosers are available and the current maximum local corwinner count has not been reached.

- If no session can be obtained, the request will be saved by the machine and retried when a session is available.

The format of the SSD returned is:

<u>Field</u>	<u>Length (bytes)</u>
Conversation ID	16
Decoded Local Max RU size (send)	4
Decoded Remote Max RU size (receive)	4
Session Polarity	2
'0000'X - contention winner	
'00001'X - contention loser	
Bind Image Length	2
Bind Image	N

- '12'X TEST AND QUIESCE: This subcommand is used to determine the existence of certain resources and requests in the machine and to defer the processing of further requests if none of the specified resources or requests exist at the time the subcommand is processed. Byte 3 of the Request Descriptor provides controlling information for this subcommand. If the Quiesce option is selected (bit 0=1), the conditions specified by bits 3-7 are tested for, and if all are true, the modename(s) specified is (are) "quiesced". This means that the following are held by the machine and not serviced until the unquiesce subcommand is received:

- Activate Resource Requests.

- Get Session Requests.

- FMH-5 attaches received from the remote LU.

- BIND requests received from the remote LU.

The following codes will be set in the error summary status field of the feedback record sent to a Test and Quiesce:

- '0000'X - All conditions specified are true. Modename(s) quiesced.

- '0018'X - Not all conditions specified are true. Modename(s) not quiesced.

No other error summary status values will be returned (except those due to MI User errors such as Invalid Modename).

- '80'x - 'ff'x :These Subcommand code points are reserved for the MSCP REQIOs.

Test and Quiesce Conditions - Char(1):

- Bit 0 = Quiesce Option:
0 = Unquiesce
1 = Quiesce
- Bits 1-2 are reserved and must be binary zeros.
- Bit 3 = No synchronous conversations.
- Bit 4 = No asynchronous, non-attach manager conversations.
- Bit 5 = No attach manager conversations.
- Bit 6 = No pending activate resource or get session requests.
- Bit 7 = The bound session and pending bound session count is zero.

Sequence Number Field - Bin (2)

- The two byte binary sequence number is not used above the MI interface in APPC.

Request/Response Unit Length - Bin (2)

- For a transmit RD, this field contains the length of the output RU. A length of zero indicates there is no RU associated with this RD.
- For a receive RD, before it is processed, this field specifies the space available in the SSD for the RU. After the receive RD is processed, this field contains the length of the received RU. If a group of receive RDs is specified in the SSR, the space available for all of the RUs can be specified in the first RD of the group. The RU length field in the remaining RDs of the group is set to zero. When the RDs in the group are processed by the machine, the RU length and offset fields are updated to the length and offset of the received RUs. The SSR can have more than one group of receive RDs. The RUs for all RDs in the SSR must be located in the same SSD.

Request/Response Header - Char(3) - Refer to definitions under 'REQUEST DESCRIPTOR SUBCOMMANDS'.

Reserved Char (1) - Always set to binary zeros.

Request/Response Unit Offset - Bin(4) - The four byte RU offset is a displacement, in bytes, to the beginning of an RU from the beginning of the SSD space. An RU associated with a specific RD can be located by displacing into the SSD space an amount equivalent to the RU offset. The RU offset for a receive RD is updated by the machine if the RU length in the RD is specified as zero (ie, the RD is designated as a part of an RD group).

Source/Sink Data Contents - Normal REQIO (CONTROL FIELD = 'N')

The SSD for the APPC Management RDs contains RUs as defined by the RDs location in the SSR. One RD defines one RU. The location of the RU within the SSD is determined by the RU offset field in the RD. For transmit RDs, the offset must be supplied to the machine in the RD. For receive RDs, the offset can be supplied for each RD or the offset can be supplied for the first RD of a group and the machine determines the offset for each subsequent RD in the group based on the length of the received RU. A receive RD is considered a member of a group if its RU length is zero. More than one group of receive RDs can be specified in an SSR but all of the RUs for those RDs must be located in one SSD.

5.7.6.4 IOM Synchronous Source/Sink Request (SSR)

The Synchronous REQIO has the same SSR template and field definitions as the Asynchronous REQIO. The only exceptions to the Asynchronous definitions and operations are as follows.

- The Control Field will indicate a synchronous REQIO via a '20'X encoded in it.
- THE PROCESS ISSUING THE REQIO WILL BE SUSPENDED UNTIL THE OPERATION IS COMPLETE IN THE SAME MANNER AS THE MODIFY INSTRUCTIONS.

- The Request I/O timeout value in the SSR template will be used to time the REQIO operation. This will guarantee that the process will not be dormant forever.
- The Synchronous REQIO operation is short in execution time.
- The SSR will be allowed only one RD.
- No feedback record will be returned.

5.7.6.5 IOM Synchronous Request Descriptor (RD)

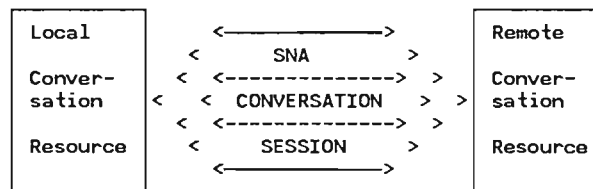
The Synchronous RD has the same layout and field definitions as all other RDs.

The RD functions are restricted to single operations.

- '01'X CONVERSATION RESET: This command causes all REQIOs for this Conversation ID to be flushed back to the user's return queue with status indicating the flushed condition when issued in the Allocated (Activate Resource REQIO complete), SEND, or RECEIVE state and does not place the path in an inactive state or cause a state transition for the LUD and CD objects. The CONVERSATION RESET function will not discard any data. This situation could cause the next operation to encounter DFC State Errors. If the Conversation Reset is issued when the Conversation is not in the Allocate state, a 'Template Value Invalid' exception will be raised.

5.7.6.6 LUS PROTOCOL BOUNDARY OVERVIEW

The Transmission Subsystem layer provides a mechanism to allow a local Conversation Resource to communicate with a remote Conversation Resource, as depicted in the following diagram.



OVERVIEW

The purpose of the Transmission Subsystem is to facilitate synchronous Conversation Resource to Conversation Resource attachment and Conversational

flows for as short or as long a period of time as desired by the programs using the Conversation Resource. The protocols provide for resource integrity across a multi-resource, multi-user scope, and define flow control mechanisms to both the Conversation Resource Manager and the Data LINK Control.

The Transmission Subsystem, therefore, provides the Conversation Resource with a high level Conversation interface for communicating with another Conversation Resource, and for controlling the interactive Conversation resource between Transaction Programs. The Conversation Resource Manager can ignore the details of a particular communication protocol because it is the Conversation's responsibility to map the SNA Session dependent interfaces to the Transmission Subsystem's High Level Interface.

DEFINITIONS

Transaction Program

A program which is placed into execution by a supervisor, and which is able to change the states of certain objects by executing sequences of instructions.

Logical Unit

The operating environment in which a Transaction Program executes.

A Logical Unit Services Manager supervises the logical unit, and provides dispatching and other service functions for the Transaction Programs within the logical unit. The Conversation Resource Manager and Transmission Subsystem is part of the Logical Unit Services Manager.

Conversation

A communication path, or flow, between two logical units over which messages may be transferred. A Conversation may exist between a local Logical Unit Services Manager and a remote Logical Unit Services Manager, between a local Transaction Program and a remote Logical Unit Services Manager and between a local Transaction Program and a remote Transaction Program.

The common case is for a local Transaction Program to create a Conversation with a remote Logical Unit Services Manager and then request the remote Logical

Unit Services Manager to create a remote Transaction Program with which the local Transaction Program will communicate.

During a Conversation, each program can send and receive data from the other. Various synchronizing commands can also be issued to a Conversation in order to handle errors, terminate the Conversation gracefully and so on.

The programs communicate over the Conversation flow via a half duplex flip-flop protocol. This means that the programs must take turns sending data because only one program at a time may do so.

RESOURCES

The objects, other than main storage, that can be manipulated by a Transaction Program.

Conversation

The Conversation, is architected by and under the control of the Conversation Resource Manager and Transmission Subsystem. It can only be manipulated by the Transaction Program through Conversation Resource Management provided interfaces. The Conversation Resource Manager will map its Transaction Program interfaces into the Conversation interfaces provided by the Transmission Subsystem.

The Conversation must be allocated to a Transaction Program and to the Conversation Resource Manager to be manipulated by each respectively. It may only be allocated to one Transaction Program/Conversation Resource Manager pair at a time. The Conversation Resource Manager and Transmission Subsystem will enforce this protocol.

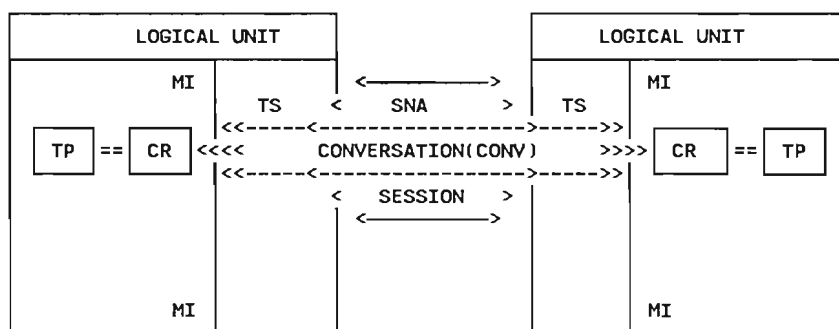
SNA Session

The SNA Session is architected by the LU6.2 IFAP. The Conversation interface to the SNA Session is architected by and controlled by the Transmission Subsystem. It can be manipulated only through the High Level Conversation Interface supported by the Transmission Subsystem.

The SNA Session must be allocated to the Conversation Resource Manager. This is enforced by the Transmission Subsystem.

The following diagram graphically depicts the terms defined so far.

APPC LOGICAL UNIT to LOGICAL UNIT STRUCTURE



- Transaction Program (TP) is the USER's application.
- Conversation Resource (CR) provides the data stream mapping and application I/O.
- Transmission Subsystem provides the LU-C protocol and Conversation resource.
- Conversation provides the resource used for I/O by the Conversation Resource Manager
 - Asynchronous Conversation does not use a SNA SESSION.
 - Synchronous Conversation does use a SNA SESSION.
- SNA Session provides the flow control necessary for data integrity.

Finite State Machines

Each Transmission Subsystem object (Conversations and SNA Sessions) has various object states associated with it. These states determine when the Transmission Subsystem user can issue various Transmission Subsystem commands. The states are maintained in Finite State Machines (FSMs) by the Transmission Subsystem.

These FSMs can change states as a result of issuing Transmission Subsystem commands. The user will be notified of any FSM reject conditions via REQIO Feedback code points.

5.7.6.7 LUS PROTOCOL BOUNDARY SUBCOMMAND/STATE MATRIX

This section describes what commands can be issued based on the setting of the FSM states. If a command is issued in a condition that the matrix does not have an 'X' in the block then the command will be terminated with a Non-Terminating error feedback indicating invalid command sequence.

The following states exist at the LUS PROTOCOL BOUNDARY (MI). They are kept in the Conversation Control Block (CCB)/Half-Session Control Block (HSCB) and are updated during the execution of protocol boundary commands by the Access Path Manager (APM) on behalf of the Transaction Program.

CONVERSATION-ALLOCATION STATES

- **ALLOCATED** The Conversation is currently allocated to the Transaction Program. This is done through the 'ACTIVATE RESOURCE' or 'GET SESSION' subcommands.
- **DEALLOCATED** The Conversation is currently not allocated to the Transaction Program. It is available for allocation. This is done through the 'DEACTIVATE RESOURCE' subcommand.

HALF-SESSION-ALLOCATION STATES

- **ALLOCATED** The Half-Session is currently allocated to the Conversation. This is done through the 'ACTIVATE RESOURCE' subcommand.
- **DEALLOCATED** The Half-session is currently not allocated to the Conversation. It is available for allocation. This is done through the 'DEACTIVATE RESOURCE' subcommand regardless of Source or Target and due to any error conditions causing in effect a session UNBIND.

HALF-DUPLEX-FLIP-FLOP STATES

- **SEND** The Half-Session is currently allowed to send data. This is done through the 'ACTIVATE RESOURCE', receive 'PREPARE-TO-RECEIVE', or SEND-ERROR.
- **RECEIVE** The Half-Session is currently allowed to receive data. This is done through the 'RCVEVOKE', 'PREPARE-TO-RECEIVE', or receive SEND-ERROR.
- **RCV-PEND** The Half-Session is pending receive state. This is done through the 'PREPARE-TO-RECEIVE'.

BRACKET-STATE-MACHINE STATES

- **BETB** The Half-Session is currently between brackets. This is done through the DETACH, UNBIND, LUSTAT, and STATION or LINE

FAILURE.

- INB The Half-Session is currently in brackets. This is done through the SEND-EVOKE, RCVEVOKE, LUSTAT BID, or BIND.

LUS PROTOCOL BOUNDARY SUBCOMMAND/STATE MATRIX;

				ACT RESRC	GET SES- SION	DACT RESRC	SEND EVOKE (FMH5)	DETACH (CEB)	SYNCPT (DR2)	SEND RSP	PREP TO RCV (CD)	SEND DATA	RCV DATA	REQ TO SEND
CCB STATES	HSCB (SNA)													
CONV- ALLOCATION	HALF- SESSION- ALLOC	HDX-FF	BSM											
DEALLOC	DE- ALLOC			V	n	V	n	n	n	n	n	n	n	n
ALLOC	DE- ALLOC			c	V	V	n	n	n	n	n	n	V	n
ALLOC	ALLOC	SEND	INB	c	n	V	V	V	V	V	V	V	V	V
ALLOC	ALLOC	SEND	BETB	c	n	V	V	n	Va	Va	Va	Va	Va	V
ALLOC	ALLOC	RCV	INB	c	n	V	p	Vr	Vr	V	V	Vr	V	V
ALLOC	ALLOC	RCV- PEND	INB	c	n	V	p	V	V	V	p	p	V	V

OUTPUT-CODES:

V: Valid command operation.
 n: Not valid. Will be ended with non-terminating error.
 Va: Valid if FMH-5 (Attach) is transmitted by accompanying RD. If no FMH-5, nonterminating error is returned.
 Vr: Valid if a reply. If not a reply, Machine will transmit but remote LU should detect a protocol error.
 p: Machine will transmit but remote LU should detect a protocol error.
 c: Cannot occur condition.

END OUTPUT-CODES;

END FSM-DEFINITION;

Feedback Record

The APPC management supports the feedback record as described in the MI Request I/O instruction.

The format of the Feedback Record is as follows:

- Bytes 00-15 Source/Sink Request Address Space PTR
- Bytes 16-17 Request ID Bin(2)
- Bytes 18-19 Error Summary Field Bin(2)

- Bytes 20-21 RD Number Bin(2)
- Bytes 22-23 RIU Segment Count Bin(2)
- Bytes 24-63 Device Dependent Area Char(40)

The Device Dependent area for Hardware Errors is as follows:

- Bytes 24-25 Device Dependent Error Code Char(2)
- Bytes 26-27 Hardware Error Code Char(2)
- Bytes 28-35 Timestamp Char(8)
- Bytes 36-37 OU# Char(2)
- Bytes 38-63 Reserved Char(26)

The Device Dependent area for Software Errors is as follows:

- Bytes 24-25 Device Dependent Error Code Char(2)
- Bytes 26-27 Software Error Code Char(2)

- | | | |
|----------|-------|-----------|
| - Bytes | 28-35 | Timestamp |
| Char(8) | | |
| - Bytes | 36-63 | Reserved |
| Char(26) | | |

See the REQIO instruction for a description of the Request Address and Request ID fields.

The ERROR SUMMARY field defines the status of the REQIO as generally defined by the REQIO instruction description. The specific values possible for APPC are itemized in Table I which follows.

The RD NUMBER is the index of the last RD processed, or the RD in error, if an error is indicated.

The RIU SEGMENT COUNT is unused by APPC and is set to binary zeros.

The DEVICE DEPENDENT AREA is binary zeros unless the presence of device dependent data is indicated by the error summary value. (See the error summary value definition in the REQIO instruction.)

The DEVICE DEPENDENT ERROR CODE is a further categorization of the hardware and software error codes, as shown in Table I.

The HARDWARE ERROR CODE is the error code logged in the hardware error log. The possible values are shown in Table I.

The SOFTWARE ERROR CODE is used to indicate further information about the LU6.2 Protocol Error. The possible values are shown in Table I and further information is present in the SNA LU6.2 FAPL Specifications. All Session outage conditions are logged in the Error Log.

The TIME STAMP corresponds to the Hardware Error Log entry.

The OU# is the same value as that present in the Hardware Error Log entry.

Table II lists the Error Summary, Device Dependent Error Codes, the Hardware/SOFTWARE Error Log Codes, that caused the problem, and recommended recovery actions.

TABLE I: APPC DEVICE DEPENDENT ERROR CODES

This table defines the various classes of Error Recovery procedures for the hardware failure error codes listed in Table II.

HARDWARE DEVICE DEPENDENT ERP CLASS	User Error Recovery (in priority order)
'0001'X	IBM Hardware or Hardware Microcode Problem (HMC or IOC) -Contact the customer engineering (CE) service representative.
'0002'X	IBM Software Problem (not HMC or IOC) -Contact the programming service representative (PSR).
'0003'X	Data Overrun, Data Underrun -Resources may be overcommitted with insufficient or excessive paging. -Contact the programming service representative.
'0004'X	Local Modem or Auto Answer Problem -With a standalone (external) modem, first verify (1) that power is turned on, and (2) that switches are in the correct operating positions. -Contact the appropriate service representative.
'0005'X	Far End, Local Coupler, or Auto Call Unit Problem -Execute the "ACU problem determination procedure" to assist in determining whom to call.

'0006'X	Auto Call Unit Problem -First, verify (1) that ACU power is turned on, and (2) that ACU and modem switches are in correct positions, and (3) cable to ACU is connected. -If the ACU is an IBM unit, contact the IBM service representative. -If the ACU is other than an IBM unit, execute the ACU problem determination procedure to assist in determining whom to call.
'0007'X	Reserved
'0008'X	Idle State Detected on the Line -The line may be open or not attached. -The far end station may be powered off. -The far end modem may be powered off. -The far end station address may not agree with that in the configuration area. -For primary lines only, the idle state detection timer value in the ND may not be sufficient for the actual propagation delays being experienced on this network. Recheck the timer value.
'0009'X	Line, Far End Hardware, or Local Hardware Problem -Execute the link test problem determination procedure to assist in determining whom to call.
'000A'X	Adapter Overrun or Underrun -Check the aggregate data rate for the adapter involved. -Check the line speed selector on both ends. Although this error will not occur if the speeds do not match, both could be set too high. -Contact the CE service representative.
'000B'X	Far End Problem -Contact the far end operator and report the symptom of this problem.

'000C'X	Redundancy Check (CRC) Error If Switched: -Retry the switched connection procedure. -Execute the link test problem determination procedure. If Remote or Leased: -Execute the Link Test Problem Determination procedure.
'000D'X	Far End has Entered Disconnect Mode -A temporary loss of power at the far end could have caused it to reset. -Contact the far end operator. -Contact the program service representative.
'000E'X	Reserved
'000F'X	SDLC Command Reject -Reset the secondary station (power off, power on). -Contact the PSR.
'0010'X	Reserved

TABLE I: APPC DEVICE DEPENDENT ERROR CODES

This table defines the various classes of Error Recovery procedures for the failure error codes listed in Table II.

SOFTWARE DEVICE DEPENDENT ERP CLASS	User Error Class
'7000'X	LU6.2 MI Protocol Boundary Interface REJECT condition (FSM REJECT).
'7001'X	LU6.2 MI Protocol Boundary Interface FM Recoverable conditon.
'8000'X	LUD Failure (LU-1 only)
'8001'X	LU6.2 Session outage condition (UNBIND '32XX'X sent, XX ~= FE)
'8002'X	LU6.2 Session outage condition (UNBIND '32XX'X received, XX ~= FE)
'XXXX'X (Bytes 2-3 of UNBIND RU)	LU6.2 Session outage condition (UNBIND '32FEXXXXXYYYY'X received or sent)

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
0000	N/A	N/A	Normal completion	No recovery necessary.
0008	N/A	N/A	REQIO continue normal completion (Terminating error reset.)	No recovery necessary.
0015	N/A	N/A	REQIO (Change Number Of Sessions) complete due to receipt of a second REQIO (CNOS).	No recovery necessary.
0018	N/A	N/A	REQIO Receive Immediate complete with no data received (also applies to a Regular REQIO Receive against an Asynchronous Conversation), or Test & Quiesce complete, Quiesce cond. unsatisfied	No recovery necessary.
0044	N/A	N/A	Source/Sink data area too small -The current request has an SSD remaining length field that is smaller than the RU received from the PEER.	1. Handle this feedback as if it were an event for unsolicited data. 2. Send the APPC IOM a REQIO to obtain the data. 3. If data is not desired, issue a Deactivate Resource REQIO. NOTE: This also recalls all outstanding Regio's for this Conversation and purges all unsolicited data. If data is purged, a negative response is sent.
4009	N/A	N/A	REQIO partially complete due to the MODLUD (Reset), Conversation Reset, MODLUD (Deactivate), or MODLUD (Vary Off) command. Some RD's were processed.	Continue performing the cleanup process.
400A	N/A	N/A	REQIO complete due to the execution of a MODLUD (Reset), Conversation Reset, MODLUD (Deactivate), or MODLUD (Vary Off) command. No RD's completed.	Continue performing the cleanup process.

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
4015	N/A	N/A	Command Terminated: -REQIO (Get Session) was issued and the CCB State is not allocated or the Half-Session is not deallocated.	1. Reissue against valid Conversation.
4024	N/A	N/A	REQIO transmit immediate error.	1. REQIO Transmit Immediate was attempted with a frame that was not valid to be sent at this time. 2. Reissue at a later time or use the non-immediate REQIO form.
6026	3206 UNBIND SENSE CODE AS IN DEV DEP ERROR WITH 'E01A'X ERROR SUMMARY STATUS	0000 UNBIND SENSE CODE AS IN HARDWARE ERROR WITH 'E01A'X ERROR SUMMARY STATUS	REQIO (Get Session) failed due to BIND negotiation failure and no other sessions exist for this MODENAME. REQIO (Get Session) failed due to - RSP received to BIND sent and no other sessions exist for this MODENAME.	Correct incompatibility with remote LU (e.g., configuration problem such as wrong MODENAME), reissue the REQIO.
402A	N/A	N/A	-REQIO (Get Session) Immediate was issued and and no session is available to satisfy the request.	1.If immediate form was used, reissue using non-immediate.
4030	N/A	N/A	Invalid Object Type.	1. An Asynchronous Resource Manager REQIO (SSR Control Field = '10'X) was issued against a LUD whose Device Type is not 'PEER'. 2. Correct the program or reissue against proper LUD.
4031	N/A	N/A	Object not Online; Invalid State Exception signaled.	Vary the object on.
4054	N/A	N/A	CONVERSATION ASYNCHRONOUS: -REQIO for Conversation was attempted and the Communication Session has been deallocated.	1. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 2. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'.
4080	N/A	N/A	REQIO (Change Number Of Sessions) was issued with invalid session count(s).	Correct session count(s) and reissue the REQIO.
4085	N/A	N/A	REQIO (Change Number Of Sessions) was issued with invalid action code.	Correct action code and reissue the REQIO.
4087	N/A	N/A	Invalid command: 1.RD contains invalid CMD bit combination	User Program Error
4088	N/A	N/A	Invalid RD sequence. A sequence	Split the REQIO operation into two REQIO

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
			of transmit/ receive/transmit is not allowed in a REQIO operation	operations. First one does transmit/ receive. Second one does the remaining transmits. NOTE: APPC management REQIOs must be of the following variety: Transmit only Transmit & Receive Receive only
408A	N/A	N/A	Conversation ID is invalid or not set.	Issue the operation again with a valid Conversation ID.
408B	N/A	N/A	Modename is invalid or not set.	Issue the operation again with a valid Modename.
6088	7000	N/A	Invalid RD sequence. -Requested RD function invalid at this time.	1.Determine the proper LUS PROTOCOL COMMAND and reissue the REQIO.
	7001	N/A	-Bracket was terminated before REQIO could complete.	
C00B	N/A	N/A	IOM Partial Damage	Vary off the LUD and CD to clear this condition. A partial damage event (CD and/or LUD) has also been signaled.
C041	N/A	N/A	SSD Space Destroyed.	1. Vary Off the LUD. 2. Correct MI User problem (SSD should not be destroyed). 3. Vary on the LUD.
C045	N/A	N/A	REQIO contains a transmit RD which specifies an RU of size larger than the maximum RU size for this LU-LU session.	Set the correct RU size in the RD. Reissue the REQIO after issuing a REQIO continue.
C084	N/A	N/A	REQIO has an Invalid SSD pointer, SSD pointer cannot be zero if the data length is not zero.	1. Issue a REQIO Continue to reset the terminating error. 1. Correct either the SSD pointer or the data length field. 2. Reissue the REQIO.
E015	8001 8002	'32XX'X CODE '32XX'X CODE	Command terminated: -Machine detected a Session outage condition and SENT UNBIND '32XX'X, XX -= FE. See FAPL for the code points. -Machine RECEIVED a Session outage condition (UNBIND '32XX'X, XX -= FE.) See FAPL for the code points.	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue normal REQIOs (receive only) until a feedback code of 0018 (NO DATA) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'.

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
E019	UNBIND SENSE CODE 'XXXX'X	UNBIND SENSE CODE 'YYYY'X	-Machine detected a session outage condition and sent UNBIND '32FEXXXXXXXX'X (protocol violation) See FAPL for the code points.	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue normal REQIOs (receive only) until a feedback code of 0018 (NO DATA) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'.
E01A	UNBIND SENSE CODE 'XXXX'X	UNBIND SENSE CODE 'YYYY'X	-Machine received a session outage condition (UNBIND '32FEXXXXXXXX'X) (protocol violation) See FAPL for the code points.	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue normal REQIOs (receive only) until a feedback code of 0018 (NO DATA) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'.
E020	8000	A240 A260	Device failure: - Unexpected DACTLU - Unexpected ACTLU	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the LUD failure event (000B 08 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0001	808B 8103 81E3 8204 84E2 E2C4 8107 8137	Link failure: IBM hardware or hardware microcode problem (HMC or IOC) - Channel error - Post event - IOC/CA parity error - DTR inactive or DTR dropped - Adapter interrupt request timeout - RTS inactive or RTS dropped - Invalid BSTAT - Read sense failure	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0002	8049 80AC 8360 8380 F660	Link failure: IBM software problem (not HMC or IOC) - Operation program error - IOC command reject - Line not initialized - SW line disc. timeout (Pri.) - MS buffer overflow	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0003	8401 F441 F481	Link failure: Data overrun, data underrun - Channel disconnect at IOC - Data overrun or channel disconnect - Data underrun or channel disconnect	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
E021	0004	8224 E324	Link failure: Local modem problem - DSR timeout or DSR dropped - CTS timeout or CTS dropped	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0008	F705	Link failure: Idle state detected on the line - Idle state detected	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	0009	F7A5 F517 F527 A380	Link failure: Line, far end hardware, or local hardware problem - Non-productive receive timeout (Pri.) - SDLC transmit sequence error - SDLC receive sequence error - SW. line disconnect timeout (Sec.)	1. Issue a REQIO Conversation reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000A	F4C2	Link failure: Adapter overrun or underrun - Adapter overrun or adapter underrun	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000B	96A5 F7C5 9227 9237 F507	Link failure: Far end problem - Request to transmit timeout (RLSD N seconds) - Frame aborted - SDLC out of range sequence number - Wrong SDLC address (Pri.) - Unrecognizable SDLC control field	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
E021	000C	F805	Link failure: Redundancy check (CRC) error - Redundancy check error (CRC)	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000D	9217	Link failure: Far end has entered Disconnect Mode - SDLC Disconnect Mode received (Pri.)	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E021	000F	9207	Link failure: SDLC Frame Reject - SDLC Frame Reject received (Pri.)	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the ND failure event (000E 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0002	8380 F660	Peer failure: IBM software problem (not HMC or IOC) - Sw. line disc. timeout (Pri.) - MS buffer overflow	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0003	8401 F441 F481	Peer failure: Data overrun, data underrun - Channel disconnect at IOC - Data overrun or channel disconnect - Data underrun or channel disconnect	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
E022	0004	8224	Peer failure: Local modem problem - DSR timeout or DSR dropped	1. Issue a REQIO Conversation Reset to reset the terminating error and return all REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0008	F705	Peer failure: Idle state detected on the line - Idle state detected	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	0009	F7A5 F517 F527	Peer failure: Line, far end hardware, or local hardware problem - Non-productive receive timeout (Pri.) - SDLC transmit sequence error - SDLC receive sequence error	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	000B	96A5 F7C5 9227 9237 F507 A220 A200 A210 A230 A250	Peer failure: Far end problem - Request to transmit timeout (RLSD N seconds) - Frame aborted - SDLC out of range sequence number - Wrong SDLC address (Pri.) - Unrecognizable SDLC control field The following apply to SDLC secondary only: - SDLC frame reject - Unexpected SDLC SNRM - Unexpected SDLC Disconnect - Unexpected DACTPU - Unexpected (2nd cold) ACTPU	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

TABLE II: APPC FEEDBACK ERROR SUMMARY CODES

Note: All feedback codes may have the MSCP bit on in the function portion of the error summary field, if the request was an MSCP type.

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
E022	000C	F805	Peer failure: Redundancy check (CRC) error - Redundancy check error (CRC)	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	000D	9217	Peer failure: Far end has entered Disconnect Mode - SDLC Disconnect Mode received (Pri.)	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.
E022	000F	9207	Peer failure: SDLC Frame Reject - SDLC Frame Reject received (Pri.)	1. Issue a REQIO Conversation Reset to reset the terminating error and return all pending REQIO's. 2. Issue Normal REQIOs (receive only) until a Feedback Code of 0018 (no data) is received. 3. Issue MSCP REQIO 'DEACTIVATE RESOURCE' followed by MSCP REQIO 'ACTIVATE RESOURCE'. 4. The specific logical unit failure reason is reported in the CD failure event (0004 05 01) and the Feedback Device Dependent Data. 5. The error is recorded in the error log.

5.7.6.8 LU SERVICES EVENTS

ND Events

ND XID Failure Event (000E 04 01)

- This event is signaled by the MSCP when a switched line connection cannot be established because the XID received from a remote CPU does not match the XID of any CD that is in the VARIED ON PENDING state so the line connection was not allowed. The event related data provides a system pointer to the ND, a length field, and the actual XID information received (up to 64 bytes).

ND Disconnect Failure Event (000E 04 03)

- This event is signaled by the MSCP whenever "DISC or RD" is received as a reply to the XID command. The event related data provides a system pointer to the ND. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

ND XID Failure Event (000E 04 05)

- This event is signaled by the MSCP for those cases where the line connection cannot be established because the remote Primary or Secondary PU sends SNA information out of sequence or XID negotiation fails. The event related data includes a system pointer to the ND, up to 66 bytes of data including a 2 byte status code which defines the failure reason, a length field and, in those cases where appropriate, the identification data (XID) received from the failing CPU. There are several failure cases which are described as follows:
 - 'B104'x--Received excess number of negotiable XID responses as replies to XID commands.
--XID included as event related data.
 - 'B108'x--Received XID response with invalid data in reply to XID command.
--XID included as event related data.

ND Line Failure Event (000E 05 01)

- This event is signaled by the MSCP whenever unrecoverable line error conditions have occurred. The event related data provides a system pointer to the ND, a 2-byte error code (described in Section- 5.7.6.7.), a timestamp, OU number and an optional system pointer to the CD (Switched Line only).

ND Line Failure "Protocol Violation" Event (000E 05 02)

- This event is signaled by communications management whenever an SNA RU is received on a T2-T4/T5 connection prior to Activate Physical Unit being processed. The event related data provides a 2 byte error code, a timestamp, and OU number. Refer to Section 5.3 for a description of the error log entry which is also recorded with the same timestamp value. Communications management does not force varying off of this ND as a part of the recovery action for this subtype. Refer also to Section 5.2.4.3.4 for error code association between this event and CD Failure (protocol violation) event

CD Events

CD Contact Successful Event (0004 04 01)

- This event is signaled when the VARY ON processing is complete and contact has been established with the remote PU. The event related data includes a system pointer to the CD and a system pointer to the ND. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

CD Contact Unsuccessful Event (0004 04 02)

- This event is signaled when the VARY ON processing being performed asynchronously by the MSCP fails. The event related data includes a system pointer to the CD, a system pointer to the ND and up to 66 bytes of data including a 2 byte status code which defines the failure reason, a length field and, in those cases where appropriate, the identification data (XID) received from the failing CPU. There are several failure cases which are described as follows:
 - '0002'x--Dial operation unsuccessful.
--XID not included as event related data.
 - '0003'x--The received XID from the remote CPU does not match the XID contained in the CD.
--XID included as event related data.
 - '0004'x--The ND is not specified in the candidate list of the CD that contained the remote CPU XID.
--XID included as event related data.
 - '000E'x--Primary SDLC received RD response in reply to XID or SNRM.
--XID not included as event related data.

- '000F'x--Primary SDLC received a station address from far end that does not match CD, but XID does match CD. (on answer).
--Station address only (2 bytes) provided as event related data.
- '0010'x--Primary SDLC received a station address from far end that does not match CD, but XID does match CD (for dial).
--Station address only (2 bytes) provided as event related data.
- 'B104'x--Received excess number of negotiable XID responses as replies to XID commands.
--Received XID included as event related data.
- 'B106'x--Received XID I-frame with error control vector.
--Received XID included as event related data.
- 'B108'x--Received XID with invalid data in I-frame.
--Received XID included as event related data.

CD Loss of Contact Event (0004 04 03)

- This event is signaled by the MSCP when a "DISC or RD" is received from the remote station. The event related data includes a system pointer to the CD, a system pointer to the ND and a 2 byte status code '0001'x, which indicates: "DISC or RD" received from the remote PU.

CD Failure "Inoperative" Event (0004 05 01)

- This event is signaled by the MSCP whenever the controller is in an inoperative condition and is not usable. The event related data provides a system pointer to the CD, the Hardware Error Code, a Timestamp and OU number.

CD Failure "Protocol Violation" Event (0004 05 02)

- This subtype is signaled by communications management (Station IOM component) whenever an SNA path error has been detected. Event related data includes a 2-byte error code, a timestamp, and the OU number. Refer to Section 5.3 for the error log entries, which are also recorded with the same timestamp value, and for further recovery actions. Communications management does not force varying off of this CD as part of the recovery action for this subtype. If the error can be corrected, the CD and LUDs below it remain operational. Refer also to Section 5.2.4.3.4 for error code association between this event and ND Failure (protocol violation) event.

CD Manual Intervention Event (0004 06 01)

- This event is signaled by the MSCP when a request is received to establish a switched connection with a remote PU and the link attachment to be used does not support the autodial feature. The event related data includes a system pointer to the CD representing the remote PU to be called, a system pointer to the ND representing the line on which to place the call, and a two byte status code of '0001'x which indicates Manual Dial Operation required. The MI process must materialize the CD and ND if it is necessary to retrieve additional information (for example, phone number and ND name or line number).

When the connection is made, a MODIFY ND (start data) is executed and the VARY ON CD processing will be completed as discussed earlier for incoming calls. If the operator responds to the MI process that the call cannot be completed, a MODIFY CD instruction maybe used to abandon the DIALING state of the CD (return to VARY ON PENDING) or to VARY OFF the CD.

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

CD Unbound Intervention Event (0004 06 02)

- This event is signaled for an APPC switched CD when all sessions for all LUDs attached to this CD are deallocated (Unbound).

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related is supplied for the subtype---the data area will contain binary zeros.

CD Switched Intervention Event (0004 06 03)

- This event is signaled by the MSCP for the following conditions:
 - When the first Activate Resource REQIO to activate the resource is received for any LUD, in a VARIED ON PENDING or higher state with the Recovery Activation status of CONTINUE, attached to a VARIED ON PENDING CD with the Recovery Activation status area indicating CONTINUE.
 - When the MODIFY CD Continue instruction is issued and an Activate Resource REQIO is present for any LUD attached to the CD.

- When the MODIFY CD Abandon Connection is issued and an Activate Resource REQIO is present for any LUD attached to the CD. NOTE: This event will not be signaled when the only attached LUD(s) with Activate Resource REQIOs pending have the Recovery Activation Status of INOPERATIVE PENDING indicated.

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

CD Primary Intervention Event (0004 06 04)

- This event is signaled by the MSCP for a leased line (Primary only), when the first Activate Resource REQIO, to activate the resource, is received for any LUD with the Recovery Activation status of NORMAL PENDING attached to a CD with the Recovery Activation status area indicating NORMAL PENDING.

The event related data includes a system pointer to the CD representing the remote Station to be contacted. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

LUD EVENTS

Conversation Unsolicited Incoming Messages Event (000B 05 20,21,22,23)

- This event is signaled by the SIOM to indicate that unsolicited data is available for this Conversation and can only be retrieved by issuing a REQIO instruction. The event data will contain a system pointer to the LUD representing the LU and the Conversation ID. The event compare value will contain the LUD pointer and the conversation ID for subtypes 20, 21 and 23 or the Mode Name for subtype 22.
- Subtype 20 indicates that the data is on the expedited flow- LU6.2 LU-LU.
- Subtype 21 indicates that the data is on the normal flow- LU6.2 LU-LU. (Signaled to the process only)
- Subtype 22 indicates an ATTACH (Program Start) request was received and the Attach Manager Conversation ID associated with the MSCP-LU Session is not activated. The Machine will send an FMH-7 X'084B6031' to this Attach and will not log the error.
- Subtype 23 indicates an ATTACH (Program Start) request was received and the maximum conversation count has already

been reached. The Machine will send an FMH-7 X'084B6031' to this Attach and will not log the error.

LUD Contact Successful Event (000B 06 01)

- This event is signaled when the asynchronous Vary On processing is complete. Event data provides a system pointer to the LUD. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

LUD Contact Unsuccessful Event (000B 06 02)

- This event is signaled when a BIND was received from the remote LU for a LUD that has one of the following conditions indicated: the LUD is in the state of Varied Off, the Recovery Activation status indicates Inoperative Pending or Cancel. The Bind is held pending until a MODIFY LUD Vary On or Continue is received. The event related data provides a system pointer to the LUD and a two byte status code of '0006'x. No additional event related data is supplied for the subtype---the data area will contain binary zeros.

LUD Device Failure Event (000B 08 04)

- The LUD failure event is signaled by the MSCP whenever a Varied On LUD goes to a state where it no longer is maintaining the LU-LU flow. Refer to Section- 5.3.3 for the Recovery Activation Status changes that occur when this event is signaled. The event related data provides a system pointer to the LUD, a timestamp, OU number and a 2-byte error code representing the following errors:
 - '0001'x---LU failure: all LU-LU sessions had to be deactivated because of a forced termination of the LU (LUD).
 - '0002'x---Invalid session parameters: the BIND negotiation has failed for all MODENAMES due to an inability to bind any session for this LU (LUD). Recovery may involve changes to the LUD Device Specific Area (DSA) at the S/38 or Remote LU.

REQIO Complete Event (000B 09 01)

This event indicates that the REQIO asynchronous processing has been completed. It is signaled only if the user requests it.

LUD Idle Sessions (000B 09 02)

- This event is signaled for an APPC LUD in the active session state attached to a switched PEER Controller (CD) that does not have "PREBOUND" sessions configured when there are no synchronous conversations, no asynchronous source conversations, and no bound sessions INB (includes all modenames - (USER and RESERVED) and one of the following conditions is present:

- At lease one session for a USER modename (does not include the reserved modename) has been INB and has gone BETB.
- A Deactivate Resource or Return Activate Resources REQIO is issued for all pending (conversation not allocated) Activate Resource REQIO's (except for those on the RESERVED modename).

LUD No Sessions (000B 09 03)

- This event is signaled for an APPC LUD, in the Active Session State, attached to a switched controller, when all sessions for all modenames (User and Reserved) change from greater than zero bound to zero bound.

The event related data provides:

- System pointer to LUD
- Data length = '0000'X
- Variable data = None

000B 09 04

- Incoming data and no outstanding request I/O (signaled only to the process which activated the session).

No variable event related data

Request I/O Response Queue Destroyed Event (000B 0A 01,02).

- This event is signaled to indicate that the return queue specified in the REQIO instruction has been destroyed. The Conversation ID is deallocated and the SNA Session is placed in an inoperative ERP state where all data is purged until the necessary synchronizaton is achieved to allow the session to be UNBOUND. The resources allocated to this session are retained and once the session is UNBOUND the inoperative condition is reset and the Session Resumed (BOUND) to allow reuse.
- Subtype 2 of this event is signaled to indicate that the return queue specified in the REQIO instruction has been destroyed. The Conversation ID is deallocated and the SNA Session is placed in an inoperative ERP state where all data is purged until the necessary synchronizaton is achieved to allow the session to be deactivated. However, the resources allocated to this session is retained and once the session UNBOUND the inoperative condition is reset and the Session Resumed (BOUND) allow reuse. Note: This LU path is also placed in terminating error mode.

5.7.6.9 LU Services Exceptions

Refer to Section 5.3.4.6 for a listing of the Resource Not Available exceptions which can be signaled for APPC communications ND's, CD's and LUD's.

5.8 COMMUNICATIONS DEVICE MANAGEMENT--3270 DEVICE EMULATION

This section describes the programming considerations and specific device support requirements for 3270 Emulation communications Source/Sink support. General information regarding the commands and objects can be found in the instruction writeups. Information on the 3270 data streams and controllers can be found in the IBM 3270 Information Display System, 3274 Control Description or 3271 Control Unit Description manuals.

BSC SUPPORT

Support for 3270 Emulation is limited to the 3271 model 2 controller for BSC. The display emulated is the 3277 with the 1920 character screen. The printers which are emulated are the 3284, 3286, and 3288 printers that have a 1920 character buffer.

SNA SUPPORT

SNA Support 3270 DE for SNA emulates the 3274 model 51C control unit running under Configuration Support A without the SFAP (Structured Field and Attribute Processing) option. The display device emulated is the 3277. The printers which are emulated are the 3284, 3286, 3288 and 3287 printers that have a 1920 character buffer. The Text Print feature on the 3288 printer is not supported, and therefore the SI (Suppress Index) order is not recognized.

The device management operates on behalf of a controller (station) or CPU and the logical unit (device) attached to the CPU. The device management performs functions necessary to complete a REQIO instruction (ie, session control, data translation, link ERP, link protocol, and protocol error recovery).

Support for 3270 Emulation is divided into 3 sections - 3270 Emulation Translation which describes the translation of data stream to 5250 format within the System/38, BSC 3270 Device Emulation sections, and SNA 3270 Device Emulation sections. The support for each of these is described in the following sections.

5.8.1 TRANSLATION 3270 EMULATION SUPPORT

5.8.1.1 REQIO

The REQIO command for translate is different than other REQIO's in that it is synchronous instead of asynchronous (ie. when the instruction completes the machine will return control to the next sequential instruction). There is no feedback record sent to the associated response queue.

The user of this command may request the machine to do one of several different translate command forms for BSC.

Refer to the Request I/O instruction for details on this command and its Source/Sink Request (SSR) object.

Minimal verification is done on the fields passed from the user in the synchronous REQIO. As an example, if a user sent a data length to the machine that was incorrect and caused the machine to address beyond the space an unrecoverable exception may occur.

The objects necessary for this REQIO to be used are the same as those defined in the following sections for BSC. The device specific parameters in the LUD are necessary for the proper execution of this REQIO and must be set up correctly.

The working space used by the translate area is pointed to from the SSR extension space and must be set up correctly. This space must not be altered or unpredictable results can occur. For performance reasons, this area should be in storage.

5.8.1.2 S/S Request (SSR) General

The SSR fields for a Synchronous REQIO for translation which specifically relate to an invocation of the REQIO to do a translate, are as follows:

LUD System Pointer field. This field will be set with a pointer to the device's LUD.

SSD Space Pointer field. This field will be set with a space pointer to the SSD. This field will be the target of the translation REQIO. See a later section on the SSD and what it may contain.

Function field. This field will be set with a value of X'8', which indicates Normal.

Function Significant Bits. This field is ignored by the translate Synchronous REQIO.

Control field. For Translation, this field should be set with a value of X'21', which indicates a Synchronous REQIO is to be done.

RD Count field. This field is ignored by the translate Synchronous REQIO.

5.8.1.3 S/S Request (SSR) Specific

The fields in the variable length area of a Synchronous REQIO, which specifically relate to an invocation of the REQIO to do a translate, are as follows:

Variable Length Data Area

0	Length of Variable (4 bytes) Length Data Area	
3	Reserved	(28 bytes)
31	Working Buffer @	(16 bytes)
47	From Buffer @	(16 bytes)
63	Data Length (From Buffer)	(2 bytes)
65	Data Length (To Buffer)	(2 bytes)
67	5250 CC Bytes	(2 bytes)
68	Max Input Field Mode	(1 byte)
69	Flags (1 byte each)	- From Buffer Format
70		- To Buffer Format
71		- Inbound Read Type
72		- Must Merge SIB
73		- Outbound Chained Command
74		- Control Information
75		- Color Option
76		- Data Stream Type
77	Reserved	(1 byte)

Note 1 : outbound in this document means 'from the host' while inbound is 'to the host'.

Note 2 : in this document SIB means machine Screen Image Buffer.

Length of Variable Length Data Area (4 byte binary number). This field must have a value of 80. Otherwise a 'Template Value Invalid' exception will be signaled.

Working Buffer @ (16 byte space pointer). This pointer is set by the invoker of the translate function and is used for all operations. Once set in place this pointer must not be changed or unpredictable results will occur. The area pointed to must be 5472 bytes in size and must be initialized to hex 0's.

From Buffer @ (16 byte space pointer). This field is only applicable if the From Buffer Data Length field is > 0. This field is set by the invoker of Translate to indicate a buffer which contains data to be translated and incorporated into Translate's SIB, and possibly returned in the SSD area if output is requested (depending on the To Buffer Data Length field). The From Buffer @ may be equal to the To Buffer @ (SSD @) provided that the mode is 3270/5250

translation mode, the From Buffer Format field and the To Buffer Format field both indicate S/38 format, and one of the following local functions is being processed:

- An inbound Roll Key during 3270/5250 translation of a 3270 display with more than 128 input fields, for which Translate should return the data.
- An ERASE INPUT key.

The buffers may overlap for outbound data streams in Program Interface mode.

Data Length (From Buffer) (2 byte binary number). This field is set by the invoker of Translate. It indicates the length of the data pointed to by the From Buffer @. A value of 0 indicates that there is no user input buffer, and that translate is to use the SIB for input data. If the value is greater than zero and the mode is Program Interface inbound, the value for the FROM buffer length must be at least 1940 bytes.

Data Length (To Buffer) (2 byte binary number). This field is used as both an input and output parameter. It is set by the invoker of Translate to indicate whether or not output should be generated, and if some should be returned, it indicates the length that can be used in the To buffer. A value of 0 indicates that no output should be returned. Any other value indicates that output should be returned in the To Buffer which is in the SSD up to the data length specified. If the value is > 0, it must be >= 1940 or an error will occur. If output is requested, then the To Buffer Format field (on REQIO) and the Mode of Emulation (in LUD at activate time) will be used to determine the format of the data to be returned. If Program Interface is being built in the To Buffer, Translate will not run off the end of the space (assuming the Data Length parameter is correct). If a data stream is being built in the To Buffer, Translate could run off the end of the space. It is the user's responsibility to provide adequate space. Upon completion of the instruction, if output was requested, Translate will set this field with the length of the data returned in the SSD Buffer. On outbound operations if this field is non zero the machine will clear all write control information after the data stream is translated.

5250 CC Bytes (2 byte bit-oriented field) This field is used as an output parameter. It is only applicable for outbound translate operations in 3270/5250 translation mode when a To Buffer has been supplied. It contains the value of the 2-byte CC (Control Characters) that is in the 5250 Write-type Command sequence in the To Buffer. The 5250 CC bytes contain the following information:

First Byte of 5250 CC

Bits 0-2	Reset Pending Aid Lock Keyboard	Clear Master MDT Reset MDT Flags in Nonbypass Fields	Clear Master MDT Reset MDT Flags in All Fields	Null Nonbypass Fields with MDT On	Null All Nonbypass Fields
000					
001	X				
010	X	X			
011	X		X		
100	X			X	
101	X	X			X
110	X	X		X	
111	X		X		X
Notes: 1. Bits 3 through 7 are reserved and should be set to 0. 2. If there are no bypass fields with MDT flags on, then the master MDT will be cleared.					

Byte 1 is always processed first. When the CCs are used with the Write-to-Display command, the first CC is processed immediately while the second CC is not processed until all the other information associated with the command has been processed.

Second Byte of 5250 CC

Bit	Code	Meaning
0		Reserved.
1		Reserved.
2	0 1	No action. Reset blinking cursor (Note 1).
3	0 1	No action. Set blinking cursor (Note 1).
4	0 1	No action. Unlock the keyboard and reset any pending aid byte (Note 2).
5	0 1	No action. Sound alarm.
6	0 1	No action. Set Message Waiting indicator off (Note 3).
7	0 1	No action. Set Message Waiting indicator on (Note 3).
Notes: 1. If bit 2 and 3 are both on, the cursor blinks. 2. If the keyboard is already unlocked, this is ignored otherwise, it: a. Unlocks the keyboard. b. Turns the keyboard clicker on. c. Turns the Inhibit indicator off. d. Moves the cursor to the address given in the last IC order (see the index entry: IC order) or defaults to the first position of the first nonbypass input field if no IC order has been given. If there is no nonbypass field, it defaults to row 1, column 1. e. Clears all unserved aid requests. 3. If bit 6 and 7 are both on, it sets the Message Waiting indicator on.		

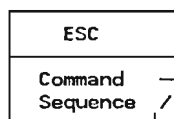
Max Input Field Exceeded Mode (1 byte indicator). This field is used as an output parameter. It is only applicable for outbound translate operations in 3270/5250 translation mode when a To Buffer has been supplied. It indicates whether or not the number of input-capable fields exceeds the maximum allowable.

- '00'X indicates not in Max Input Field Exceeded Mode.
- '01'X indicates in Max Input Field Exceeded Mode.

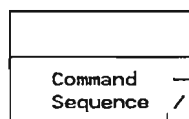
From Buffer Format (1 byte indicator). This field is set by the invoker of Translate, and is used by Translate to determine the format of the data in the from buffer.

- '00'X indicates a host format, which is a 3270 data stream in the following format:

BSC



SNA



- '01'X indicates a S/38 format, which is either Program Interface without Field Level Entries, Program Interface with Field Level Entries, or 3270/5250 translation mode depending on the Emulation mode which was specified in the device's LUD at the time the session was activated. If in 3270/5250 translation mode, the From Buffer must contain an inbound 5250 data stream in one of the following formats, as indicated by the Inbound Read Type field:
 - If Inbound Read Type = '00'X, then the 5250 data stream must be the result of a READ MDT FIELDS command issued to the 5250.
 - If Inbound Read Type = 'B', 'M', or 'A' the 5250 data stream must be the result of a READ SCREEN (immediate) command issued to the 5250.
 - If Inbound Read Type = 'T', the 5250 data stream must be the result of a READ SCREEN (immediate) command issued to the 5250.

For local processing (From S/38 format to S/38 format), the Inbound Read Type Parm is ignored, and the 5250 data stream must be the result of a READ MDT FIELDS command issued to the 5250.

To Buffer Format (1 byte indicator). This field is set by the invoker of Translate, and is used by Translate to determine the format of the data in the To Buffer.

- '00'X indicates a host format, which is a 3270 data stream.
- '01'X indicates a S/38 format, which is either Program Interface without Field Level Entries, Program Interface with Field Level Entries, or

3270/5250 translation mode depending on the Emulation mode which was specified in the device's LUD at the time the session was activated.

Inbound Read Type (1 byte indicator). This field is set by the invoker of Translate. This field is only applicable for inbound operations, where defining inbound to mean anytime (the To Buffer Length > 0 and the To Buffer Format indicates a host 3270 data stream format) or (the To Buffer Length = 0, and the From Buffer Format indicates a S/38 format).

- '00'X indicates that AID (other than test request) was generated and the inbound data is not the direct result of a READ BUFFER, READ MODIFIED (ALL) or READ MODIFIED outbound command from the host. This is not a valid value (and an error will result) if the From Buffer Data Length = 0, and the To Buffer Data Format indicates a host 3270 data stream format.
- 'T' indicates that test request AID was generated and the inbound data is not the direct result of a READ BUFFER, READ MODIFIED (ALL) or READ MODIFIED outbound command from the host. This is not a valid value (and an error will result) if not in 3270/5250 translation mode. If the From Buffer Data Length = 0, then there is no data associated with the test request. If the From Buffer Data Length > 0, then the From Buffer contains the test request data.
- 'B' indicates that the inbound data is the direct result of a READ BUFFER outbound command from the host. If the From Buffer Data Length = 0, then the 3270 inbound data stream will be formatted from the current contents of the SIB.
- 'M' indicates that the inbound data is the direct result of a READ MODIFIED outbound command from the host. If the From Buffer Data Length = 0, then the 3270 inbound data stream will be formatted from the current contents of the SIB. There is one situation where this 'M' value may be used even if the inbound data is not the direct result of a READ MODIFIED command. If a From Buffer is supplied with the result of a READ SCREEN (immediate) command issued to the 5250 while in 3270/5250 Translation mode, and no To Buffer is supplied, then Translate may be invoked with an Inbound Read Type of 'M' in order to update the SIB with the current contents of the 5250 display. This situation should only be necessary if Translate's invoker finds it necessary to save the contents of the 5250 display when AID has not been generated at the 5250.
- 'A' indicates that the inbound data is the direct result of a READ MODIFIED ALL outbound command from the host. If the FROM buffer data Length = 0, then the 3270 inbound data stream will be formatted from the current contents of the SIB. The resulting data stream will be formatted as for a READ MODIFIED command except that the AID byte is no longer a determining factor, i.e., a READ MODIFIED inbound data

stream will be returned regardless of the AID byte.

Must Merge SIB (1 byte indicator). This field is set by the invoker of Translate, and is only applicable when the invoker has requested output (i.e. To Data Length is > 0) and the session is in 3270/5250 translation mode (value specified in LUD at activate time). This field is applicable for both inbound and outbound translation operations. When applicable, this field must be set if the SIB contains any data from a previous translation that has not yet made it to its final destination (i.e. to the 5250 for outbound data, or to the host for inbound data). This could either result from a previous invocation of translate with a To Buffer Data Length of 0, or from translate's invoker not sending the results of a previous translate operation to the expected destination. In 3270/5250 translation mode, Translate will first attempt to translate data directly from the From Buffer to the SSD To Buffer at the same time it is updating Translate's SIB. If this is not sufficient (e.g. Translate's previous invocation was for an outbound translation for which no output data stream was requested), this field must be set so that translate knows to update the SIB first and then use the entire SIB to build the proper data stream to be returned. For performance reasons, it is important to only turn on this field when necessary, since data stream to data stream translations are quicker than re-constructing the data stream from the SIB. For outbound translations, this performance difference could be significant. For inbound translations, the difference is extremely small.

- '00'X indicates that the SIB does not have to be merged for the data that is to be returned to be complete.
- '01'X indicates that the SIB does have to be merged for the data that is to be returned to be complete.

Outbound Chained Command (1 byte indicator). This field is set by the invoker of Translate, and is only applicable for an outbound command (From Buffer Format indicates 3270 data stream), or for the inbound response to an outbound Read type command (Inbound Read Type = 'B' or 'M').

- '00'X indicates that the outbound command was not chained.
- '01'X indicates that the outbound command was chained from the previous outbound command for which Translate was invoked. If this is the inbound response to an outbound Read type command, then this indicates whether or not the outbound Read type command was chained to the command before it.

Note: For BSC, a chained command is any command other than the first command between a SELECT and an EOT.

Control Information (1 byte indicator). This field is set by the invoker of Translate, and is only applicable for outbound translate operations. It is

necessary because certain control information (e.g. Write-Control Information) will need to be accumulated across more than one invocation of translate, and translate may not assume that the existence of a To Buffer guarantees that the information returned in the To Buffer will be sent to the 5250 (for 3270/5250 translation mode) or to the user program (for Program Interface mode).

- '00'X indicates that any Write-Control Information accumulated from previous translations should be cleared (and for Program Interface for printers, the blocksize should also be cleared), before this translation begins.
- '01'X indicates that the Write-Control Information (and for Program Interface for printers, the blocksize) accumulated since the last time translate cleared the Control Information, along with the information provided for the current translation, should be used for the current translation.

Color Option (1 byte indicator). This field is set by the invoker of Translate, and is only applicable for outbound translate operations in 3270/5250 translation mode for which the To Buffer Data Length > 0. This option will result in up to 4 colors being displayed on any 5250 compatible work station which has color support. The colors will be determined based on the following attributes:

<u>3270 attribute of field</u>	<u>color displayed on 5250</u>
unprotected, normal display	green
unprotected, intensified display	red
protected, normal display	blue
protected, intensified display	white

Unprotected 3270 fields which fall outside the window in 'maximum input field exceeded' mode will be treated as protected, and will display as either blue or white. This color option should not be turned on for a work station that does not provide color support, as it will result in column separators, and/or high intensity, and/or blinking occurring where not anticipated.

- '00'X indicates that the translation should not include color support.
- '01'X indicates that the translation should include color support.

DATA STREAM TYPE (1 byte indicator). This field is set by the invoker of Translate and is only valid for outbound translate operations for which the FROM buffer data length is greater than zero and the line discipline is SDLC. This field indicates whether the data stream is in 3270 DSC (Data Stream Compatibility) or SCS (SNA Character Strings) format.

- '00'X indicates that the data stream in the FROM buffer is in 3270 DSC format.
- '01'X indicates that the data stream in the FROM buffer is in SCS format.

The following table indicates the action taken by Translate for all of the possible combinations of From Buffer Formats and To Buffer Formats. If the From Buffer Data Length = 0, the From Buffer @ and the From Buffer Format parameters are ignored. Likewise, if the To Buffer Data Length = 0, The To Buffer @ (SSD @) and the To Buffer Format parameters

are ignored. Since, these rules are always the same, the table does not specifically address whether or not these parameters are applicable. The Working @ parameter is also not mentioned in the table, since it is always applicable. For all of the other parameters, the table specifically addresses whether or not they apply.

From Buffer Format	To Buffer Format	Action taken by Translate, and Parameters which are applicable.
N/A (From Data Len = 0)	N/A (To Data Len = 0)	Template Value Invalid Exception.
N/A (From Data Len = 0)	Host, 3270	Valid for all modes of Emulation. Template Value Invalid Exception if - Inbound Read Type parm does not indicate READ BUF., READ MOD (ALL) or Test Request. - Program Interface mode, and Inbound Read Type parameter indicates a test request. - 3270/5250 translation mode, and Must Merge SIB parm indicates 'Do not have to merge SIB'. The following parms are applicable: - Inbound Read Type - Must Merge SIB (only applicable in 3270/5250 translation mode) - Outbound Chained Command (only applicable if this is the inbound response to an outbound Read type command) The following parms are ignored: - 5250 CC Bytes - Max Input Field Exceeded Mode - Write-Control Information - Color Option - Data Stream Type The data in the SIB is returned in the 3270 data stream format specified by the Inbound Read Type parameter.

From Buffer Format	To Buffer Format	Action taken by Translate, and Parameters which are applicable.
N/A (From Data Len = 0)	S/38	Valid for all modes of Emulation. Template Value Invalid Exception if - 3270/5250 translation mode, and Must Merge SIB parm indicates 'Do not have to merge SIB'. The following parms are applicable: - Must Merge SIB (only applicable in 3270/5250 translation mode) - 5250 CC Bytes (only applicable in 3270/5250 translation mode) - Max Input Field Exceeded Mode (only applicable in 3270/5250 translation mode) - Write-Control Information - Color Option (only applicable in 3270/5250 translation mode) The following parms are ignored: - Inbound Read Type - Outbound Chained Command - Data Stream Type The contents of the SIB are returned in the S/38 format that is indicated by the Mode of Emulation.

From Buffer Format	To Buffer Format	Action taken by Translate, and Parameters which are applicable.
Host, 3270	N/A (To Data LEN = 0)	Valid for all modes of Emulation. Template Value Invalid Exception if - The command in the 3270 data stream is a Read type command. The following parms are applicable: - Outbound Chained Command - Write-Control Information - Data Stream type (only when line discipline is SDLC) The following parms are ignored: - Inbound Read Type - Must Merge SIB - 5250 CC Bytes - Max Input Field Exceeded Mode - Color Option The SIB is updated according to the 3270 data stream in the From Buffer
Host, 3270	Host, 3270	Template Value Invalid Exception.

From Buffer Format	To Buffer Format	Action taken by Translate, and Parameters which are applicable.
Host, 3270	S/38	Valid for all modes of Emulation. Template Value Invalid Exception if - In 3270/5250 translation mode or if the device is a printer, and The command in the 3270 data stream is a Read type command. The following parms are applicable: - Must Merge SIB (only applicable in 3270/5250 translation mode) - Outbound Chained Command - 5250 CC Bytes (only applicable in 3270/5250 translation mode) - Max Input Field Exceeded Mode (only applicable in 3270/5250 translation mode) - Write-Control Information - Color Option (only applicable in 3270/5250 translation mode) - Data Stream type (only when line discipline is SDLC) The following parms are ignored: - Inbound Read Type The 3270 data stream is used to update SIB and output S/38 format which is determined by the mode of emulation. For Program Interface the outbound command may be a Read type command.

From Buffer Format	To Buffer Format	Action taken by Translate, and Parameters which are applicable.
S/38	N/A (To Data Len = 0)	Valid for all modes of Emulation. Template Value Invalid Exception if - Program Interface mode, and Inbound Read Type parameter indicates a test request. The following parms are applicable: - Inbound Read Type. - Outbound Chained Command (only applicable if this is the inbound response to an outbound Read type command) The following parms are ignored: - Must Merge SIB - 5250 CC Bytes - Max Input Field Exceeded Mode - Write-Control Information - Color Option - Data Stream Type The SIB is updated with the S/38 data in the From Buffer.
S/38	Host, 3270	Valid for all modes of Emulation. Template Value Invalid Exception if - Program Interface mode, and Inbound Read Type parameter indicates a test request. The following parms are applicable: - Inbound Read Type - Must Merge SIB (only applicable in 3270/5250 translation mode) - Outbound Chained Command (only applicable if this is the inbound response to an outbound Read type command) The following parms are ignored: - 5250 CC Bytes - Max Input Field Exceeded Mode - Write-Control Information - Color Option - Data Stream Type The SIB is updated with the S/38 data in the From Buffer, and a 3270 data stream is output.

From Buffer Format	To Buffer Format	Action taken by Translate, and Parameters which are applicable.
S/38	S/38	Only valid for 3270/5250 translation mode. Template Value Invalid Exception if - In Program Interface mode. - If in 3270/5250 translation mode but not processing one of the following local functions: - If processing a Roll key in 128 input field restriction mode. - If emulating an ERASE INPUT - If Must Merge SIB parameter indicates 'Do not have to merge SIB'. The following parms are applicable: - Must Merge SIB (only applicable in 3270/5250 translation mode) - 5250 CC Bytes (only applicable in 3270/5250 translation mode) - Max Input Field Exceeded Mode (only applicable in 3270/5250 translation mode) - Color Option (only applicable in 3270/5250 translation mode) The following parms are ignored: - Inbound Read Type - Outbound Chained Command - Write-Control Information (The Write-Control info won't be used or cleared during the current translation.) - Data Stream Type

'03'X
'04'X

PA3
Erase input

6. An AID value for Test Request will not be recognized in the From buffer. To get the specified results for a Test Request Key, use the Inbound Read Type parameter on the REQIO interface.
7. To perform the functions of the Erase EOF key use the Field Exit key. It should be noted that limitations exist with this key (ie. the Field Exit key will not clear a wrapping unprotected field, it will clear numeric fields, and it will move the cursor to the next unprotected field).
8. 24 function keys are supported.
9. The 3270 field mark key is not supported.
10. An RA order can not have any of the nonprinter orders as its repeat character.
11. All data bytes from the 5250 will be converted to upper case if the LUD so specifies (for 3270/5250 Emulation only).
12. For both Program Interface and 3270/5250 Translation mode, the From Buffer Data Length parameter on the REQIO interface indicates if Read Buffer and Read Modified commands should provide full 3270 support or whether they should be read directly from the screen image buffer. For Program Interface mode, full support means that the read command will be passed to the Program Interface user in Program Interface format. For 3270/5250 Translation mode, full support means that Translate expects to be invoked with the inbound results of a Read Screen (immediate) to the 5250 device. The read commands will be handled from the screen image buffer by translate as long as the correct options is taken when it is invoked. This is true for all the buffer formats except the 3270 Data Stream Mode (not-translated), which is not supported by Translate.
13. A read modify command received while in 3270/5250 emulation mode may result in some data not being transferred. The machine is unable to detect the overkeying of identical data without an AID key being depressed. Should this condition arise the overkeyed data would not be returned to the host with the read modify command but would be returned when an AID key is depressed. For read buffer the same conditions can occur. The data will be returned but the MDT's will not be turned on for identical overkeyed data unless an AID had been depressed.
14. Under certain conditions, when the NL and EM printer orders are sent to a 3270 display type device, they are displayed as '5's and '9's. For our emulation support, these printer orders will be sent to a display device without being altered, and since they are both under X'40', they will be displayed as an unprintable character would be.
15. The language option performing Emulation must be specified in the LUD object. This is necessary due to the different character sets. These options are only applicable for 3270/5250 Translation mode.
16. The maximum amount of data that the machine will accept from the link is limited to 5120 bytes.
17. All 3270 remote commands work on both local and remote 5250 terminals doing Emulation along with being sent up to a user program if selected. The user should be aware that BSC 3270 Emulation is open to line timing problems based on the S/38 design, S/38 work load, the amount of work being done for some commands (ie. read buffer or read modify), and the time to handle a remote line.
18. When using data buffer formats 1 (no translate) or 3 or 4 (program interface) all non-display output fields will be sent to the user. It is user's responsibility to handle the security of the data.
19. The Numeric Lock feature is only applicable for 3270/5250 emulation sessions. It should be noted that once the numeric lock feature is specified for a device it can be overridden by using the shift key. No checking will be done on the data being entered to verify that it is proper (unlike a real 3270 display). Specification of the Numeric Lock feature in the 3270 Emulation LUD will cause unprotected numeric fields to be automatically shifted.
20. While a session is in either Program Interface or 3270/5250 Translation mode, the Test Request key (and any data) will be sent to the host, and there will be no On Line Test support executed on the S/38 for that device. To run a 3270 On Line Test the ND,CD, and a LUD (to have the test run against) must be varied on and the LUD may not be in an active session. On Line Test is supported from the Start PDP command only from console or a workstation not in Emulation mode.
21. Null suppression for 3270/5250 emulation inbound data streams will differ from null suppression for an actual 3270 inbound data stream. An actual 3270 will suppress all nulls (leading, trailing, and imbedded). 3270/5250 emulation can only suppress trailing nulls. Leading and imbedded nulls are converted to blanks and transmitted to the host.
22. The DUP key support will differ slightly from that of a real 3270. When the DUP key is pressed on a real 3270, a single overscore '*' character is placed in the buffer. On a 5250, an overscore '*' is placed in the entire field and not just the single character as in the 3270 (note that the though the characters display differently the same hex value 1C is returned for both). For both 3270's and 5250's, the keyboard operator may move the cursor back and re-key over all or a portion of the field. If an entire field is filled with the overscore

'*', translate will return to the host a single overscore '*' followed by the remainder of the field as it was written to the 5250. If an entire field is not filled with the overscore '*'s, translate will return to the host the exact content of the field as it was returned from the 5250.

23. On a 3270, the Write-Control Information indicates whether or not the keyboard state should be reset to uninhibited. On a 5250, the Write-Control Information indicates whether the keyboard should be locked or unlocked. Translate will handle this discrepancy by keeping track of the keyboard state of the 5250. On an outbound translation, translate will unlock the 5250 keyboard if either the host indicated to reset the keyboard, or if the keyboard was already unlocked. We will assume that the keyboard is locked by any inbound operation with the From Buffer in a READ MDT format, and that the keyboard state is not altered by an inbound operation with the From Buffer in a READ SCREEN format. For local to S/38 translations (ROLL keys while in max input field exceeded mode, and the ERASE INPUT key), translate will always unlock the keyboard.
24. The Auto Skip support will differ slightly from that of a real 3270. On a real 3270, Auto Skip will skip over protected numeric fields. On a

5250, it will skip over all protected fields.

25. Our 3270/5250 Emulation support will maintain the keyboard state (inhibited or uninhibited) in the same manner it would be maintained on a real 3270. However, the 5250 does not allow the user to use the RESET key to unlock the keyboard as the 3270 does. This means that applications that never unlock the keyboard will not be able to use our 3270/5250 Emulation support, unless S/38 provides a way for the 5250 user to unlock the keyboard while in 3270/5250 Emulation mode.
26. Our 3270/5250 Emulation support only allows a maximum of 960 fields. If a buffer from the host system is received with more than that number, an exception will occur.
27. The Erase Write Alternate command will be treated as an Erase Write and will not change the screen size.
28. For inbound translations with a short read aid byte, the screen image buffer will be updated with any modified fields even though modified fields are not sent to the host.

5.8.1.8 REQIO Exception Codes

This section defines the exceptions and the meaning for an error condition on the translate REQIO (there is no feedback record).

5.8.1.9 Function Check

For LUD objects this Synchronous REQIO instruction can signal a function check for the following reasons:

<u>Command</u>	<u>Reason</u>
REQIO	- Invalid or null pointer specified. - Data length is incorrect. - Working Buffer @ area altered

5.8.1.10 Configuration Invalid Exception

For Emulation LUDs, the REQIO instruction can signal the Configuration Invalid exception ('3401'X) for the following conditions:

<u>Command</u>	<u>Exception Data</u>	
	<u>Generic</u>	<u>Reason</u>
REQIO	'3403'X	The LUD is not in the proper state to invoke the Translate function. 1) The Buffer Format field in the device specific area of the LUD does not indicate one of the following: Translation modes: - Program Interface without Field Level Entries. - Program Interface with Field Level Entries. - 3270/5250 Translation mode.

5.8.1.11 S/S Resource Not Available Exception

For Emulation LUDs, the REQIO instruction can signal the S/S Resource Not Available exception ('3404'X) for the following state change requests:

<u>Command</u>	<u>Exception Data</u>	
	<u>Generic</u>	<u>Specific</u>
REQIO	'3401'X	'0001'X-AID is incorrect (3270/5250 Translation only). AID values supported by Translate on inbound operations are as follows: - 5250 CF Key AIDS - 5250 Clear Key - 5250 Enter/Rec Adv - 5250 Roll Keys (only valid in 'Max Input Field Exceeded' Mode) - '01'X (PA1) - '02'X (PA2) - '03'X (PA3) - '04'X (Erase Input) '0002'X-Invalid command or order. (SNA -resp '1003'x) '0003'X-Invalid address or parameter. (SNA -resp '1005'x) '0004'X-More than 960 fields received.

5.8.1.12 Template Value Invalid

For LUD objects the Synchronous REQIO instruction can signal the Template Value Invalid exception ('3801'X) for the following additional reasons. The field name in parenthesis after each reason indicates the field which will be indicated by the exception data. The Generic code will be the offset of the field from the beginning of the SSR, and the Specific code will be the length of the field. In the following table, the Generic code is described in terms of X, where X is the offset of the start of the variable length data area portion of the SSR.

<u>Command</u>	<u>Reason</u>	<u>Exception Data</u>	<u>Generic</u>	<u>Specific</u>
REQIO	1) Reserved space not zero. (Reserved field)		X + 77	1
	2) Variable data area length does not equal 80 bytes. (Length of Variable Length Data Area)		X + 0	4
	3) To Buffer Length is > 0, but < 1940. (To Buffer Length field)		X + 65	2
	4) From Buffer Format is not '00'X or '01'X. (From Buffer Format field)		X + 69	1
	5) To Buffer Format is not '00'X or '01'X. (To Buffer Format field)		X + 70	1
	6) Inbound Read Type violates one of these: - It is not '00'X, 'B', 'M', or 'T'. - It is a 'T' and in Program Interface mode. - It is an 'A' and line discipline is BSC. (Inbound Read Type field)		X + 71	1
	7) - It is a '00'X, and the other parameters are set up for a 'Read directly from SIB' Read type operation (From Buffer Data Length = 0, and To Buffer Data Format indicates a host 3270 data stream format). (Inbound Read Type field)		X + 71	1
	8) Both From Buffer Data Length and To Buffer Data Length = 0. (To Buffer Data Length field)		X + 65	2
	9) Both From Buffer Format and To Buffer Format = '00'X (host,3270). (To Buffer Format field)		X + 70	1
	10) Both From Buffer Format and To Buffer Format = '01'X (S/38), and this is not 3270/5250 translation mode processing one of the following local functions: - Roll key in 128 input field restriction mode. - ERASE INPUT key. or this is 3270/5250 translation mode with a From Buffer in S/38 format indicating one of those local functions and there is a To Buffer that is not in S/38 format. (To Buffer Format field)		X + 70	1
	11) Outbound data without a To Buffer (From Buffer Format = '00'X and To Buffer Data Length = 0) and the command in the 3270 data stream is a Read type command. (To Buffer Data Length field)		X + 65	2
	12) Outbound data (From Buffer Format = '00'X) and (in 3270/5250 translation mode or the emulation device is a printer) and the command in the 3270 data stream is a Read type command. (From Buffer Format field)		X + 69	1
	13) In 3270/5250 Translation mode, and (From Buffer Data Length = 0, or Both From Buffer Format and To Buffer Format = X'01' (S/38)) and the SIB does not have to be merged (Must Merge SIB = '00'X). (Must Merge SIB field)		X + 72	1
	14) From Buffer and To Buffer are both supplied and they overlap each other. There are exceptions to this condition: - The buffer pointers may overlap if the direction is outbound and the mode is Program Interface			

- The buffer pointers may be equal if both buffers are in S/38 format, and this is 3270/5250 translation mode processing one of the following local functions:
 - Roll key in 128 input field restriction mode.
 - ERASE INPUT key
- (From Buffer 2) X + 47 16
- 15) In Program Interface mode, and From Buffer Data Length is > 0, but < 1940.
(From Buffer Data Length) X + 63 2
- 16) Outbound translate (From Buffer Format = '00'X or (From Buffer Data Len = 0 and To Buffer Format = '01'X)), and the Clear Write-Control Info parameter does not contain a '00'X or '01'X.
(Clear Write-Control Info) X + 74 1
- 17) The device is a printer, and From Buffer Data Length is > 0, and From Buffer Format = '01'X (S/38).
(From Buffer Data Length) X + 63 2
- 18) In 3270/5250 translation mode, and the translation is an outbound translation or a local function, and the To Buffer Data Length is > 0, and the Color Option is not '00'X or '01'X
(Color Option) X + 75 1
- 19) For an outbound data stream, the line discipline is SDLC and the data stream type is not '00'X or '01'X.
(Data Stream Type) X + 76 1
- 20) From Buffer Type = '00'X (Host), the Data Stream Type = '01'X (SCS), and the From Buffer Length > 256.
(From Buffer Length) X + 63 2

5.8.2 BSC 3270 EMULATION SUPPORT

5.8.2.1 Communications Device Attachment (ND and CD)

The communications object configuration for attachment of BSC 3270 Emulation communications LUD objects to System/38 is shown in Figure 1. The LUD type requires the creation of both ND and CD objects. The specific data required in the ND, CD, and LUD for a given line type is discussed in subsequent sections. Up to 32 LUD's may be attached to a CD, and one CD is attached to an ND. It should be noted that along with the Emulation LUD's, up to 32 BSC Tributary LUDs can be attached to the same CD though they cannot be varied on at the same time. Only leased line support is provided for BSC 3270 Emulation Support.

5.8.2.2 Communications Device Logical Unit Description (LUD)

All BSC 3270 Emulation communications devices require a Logical Unit Description (LUD) object to be created for their support. These LUDs are of a LUD type '30' for which a Network Description (ND) object and Controller Description (CD) object are required. All information necessary to create LUDs for each specific communications device will be supplied in the subsequent sections. That information which is common to all LUDs, such as name, creation options, forward pointers, type definitions, associated space, and etc, is defined by the Source/Sink architecture. LUD's are used to represent the individual paths or sessions to the various 3270 display or printer devices which are being emulated by this support.

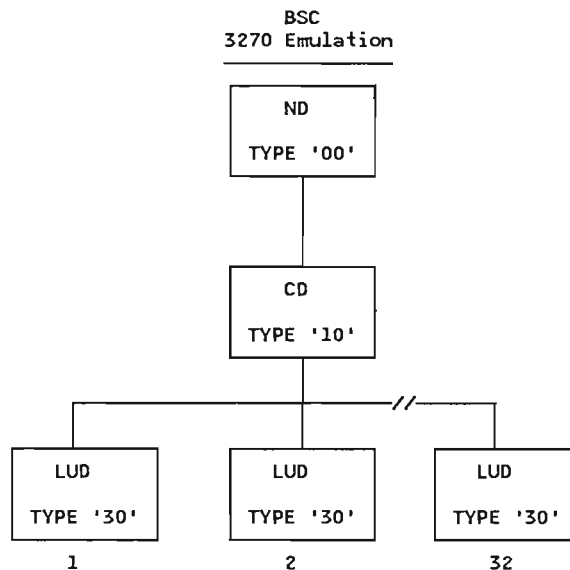


Figure 1 Comm Object Configuration--BSC 3270 Emulation

5.8.2.3 Programming Considerations

Communication is accomplished through data paths. A path is activated when a REQIO is executed. To manage these paths, the device management supports the following MI commands.

MODND:	Vary On/Off/Selectable Modes Cancel/Continue
MODCD:	Vary On/Off/Selected Modes Cancel/Continue
MODLUD:	Vary On/Off/Device Specific Area Cancel/Continue Activate/Deactivate Reset Suspend Quiesce
REQIO:	Functions - Normal Control - Normal Continue

Prior to using any of these commands, the user must create the network describing the line-ND, the controller-CD, and the device(s)-LUD. This is done by using the following MI support code instructions:

CRTND	- Create Network Description
CRTCD	- Create Controller Description
CRTLUD	- Create Logical Unit Description

See appropriate sections for the template data needed to create the objects for the line(ND), station(CD), and device(LUD).

5.8.2.4 Modify ND

MODND (Vary On/Off)

These commands are used to activate or deactivate the Emulation communications line appearance.

MODND (Selectable Modes)

This command is used to select the 3270 Emulation protocol mode, the modem rate (full or half speed) and the character encoding (EBCDIC or ASCII).

MODND (Cancel)

This command is used to suspend the reconnection and reuse of the communications line.

MODND (Continue)

This command is used to enable (allow) the reuse of the line after an unrecoverable error has occurred.

5.8.2.5 Modify CD

MODCD (Vary On/Off)

This command is used to perform preliminary setup for the communication path to the physical unit in the CPU or station represented by the CD.

MODCD (Selectable Modes)

This command is used to change the delay time for this program and delay time for this device.

MODCD (Cancel)

This command is used to suspend the reconnection and reuse of the controller.

MODCD (Continue)

This command is used to enable (allow) the reuse of the controller and request that contact be established after an unrecoverable error has occurred.

5.8.2.6 Modify LUD

MODLUD (Vary On/Off)

These commands perform preliminary set up for the Emulation data path.

MODLUD (Device Specific Area)

This command is used to change the buffer format mode selections, the allowable number of input fields, and the type of terminal that the Emulation is being done on. These fields can be changed at any time but the information will not take effect until after the next Deactivate-Activate session sequence.

MODLUD (Cancel)

This command is used to suspend a device after an unrecoverable error has occurred.

MODLUD (Continue)

This command is used to enable (allow) the reuse of the device after an unrecoverable error has occurred.

MODLUD (Activate)

This command is used to prepare the communication path from the System/38 LU to the CPU or station's LU. MODLUD (activate) is also used to reactivate the path when it is in reset, suspended, or quiesced STATE. At Activate time (after a deactivated session or Vary On) the machine will send Device End status to the host. At Activate time (after a Deactivated session) the machine will verify the Device Specific parameters and use them for all subsequent translate REQIO'S.

MODLUD (Deactivate)

This instruction is used to deactivate the communications path from the system to the CPU or station.

MODLUD (Reset)

These operations cause all REQIOs pending for this LUD to be flushed back to the user's return queue, in sequential order and with a feedback status code to the user. The number of request descriptors processed will also be set in the feedback record. This command also places the path in an inactive state, which can be reactivated with a MODLUD (Activate) command. All available unreceived data is discarded by this instruction.

MODLUD (Quiesce)

This command will be rejected to force a Modlud (Reset) operation to be performed.

MODLUD (Suspend)

This command causes REQIO processing to be suspended at the next REQIO boundary for REQIO's on this LUD. A MODLUD (activate) command will cause processing to restart.

5.8.2.7 SYNCHRONOUS REQIO

This command, called cancel invite will bring back a first receive REQIO (bit 0 on in the RD and bit 4 on in the SSR) and all REQIOs following that first receive until another first REQIO is found. The REQIOs will be flushed back to their appropriate feedback queues with the proper error summary. This command does not cause any other state changes for the session and will not discard data that has already been received. If the command is issued after the data has already been queued then the cancel invite is sent back failed.

5.8.2.8 ASYNCHRONOUS REQIO

This command is used for three purposes. First, it is used to perform I/O on the data path. Second, it is used to cause a Poll/Select eligibility on a connection. Third, the REQIO (continue) is used to return the logical unit to active path state after it has encountered a terminating error.

ASCII is supported for BSC 3270 Emulation, as follows:

- Data to be sent to the Host is translated from EBCDIC to ASCII code. The translated data overlays the original data in the SSD. EBCDIC characters that do not have an equivalent ASCII character are replaced by '1A'X (ASCII SUB character).
- Data received from the Host is translated from ASCII to EBCDIC code. ASCII characters that do not have an equivalent EBCDIC character are replaced by '3F'X (EBCDIC SUB character).
- Neither the machine user nor the control station is informed when a character is replaced by the SUB character.

The maximum block that will be allowed from a host will be 5120 bytes. If the block is greater than this a session failure will occur.

Only 1 block of data can be transmitted or received per REQIO. EOT will be sent after transmitting the data block.

Refer to the Request I/O instruction for details on the REQIO command and its Source/Sink Request (SSR) object.

No verification is done on the data block passed to the machine from the user. Verification is done on

the data blocks received from the line. If a block received is invalid, EOT will be sent to the far end and a REQIO for this session will be returned with session failure status.

For outbound data streams if an invalid 3270 format is received, a station failure error summary value will be returned in the feedback record and status sent to the host system.

Data passed to the machine or data passed from the machine must be in 3270 data stream format. To convert this data stream issue a translate REQIO (see section 1.2).

Transparency is not supported.

Data for sessions will be buffered ahead if no REQIO's are available. Data may not be transmitted to the host until this data has been returned in a REQIO('s).

S/S REQUEST (SSR) GENERAL

The SSR Function Field bits have the following meanings for 3270 Emulation device management:

Bits 0-3 - The only valid value is X'8' - normal path.

Bits 4-7 - These bits define the content and type of I/O being requested. The valid values and their meanings are:

Bit 4 - Indicates that this read or write is the first operation.

Bit 5 - Unused by 3270 Emulation.

Bit 6 - Indicates that this REQIO contains a Send RD

Bit 7 - Indicates that this REQIO contains a Receive RD.

The following programming rules apply to bits 4-7.

1. For REQIO Continue, bits 4-7 must all be zero.
2. The sequence of operations specified by a sequence of REQIOs must adhere to BSC link protocol requirements specified by CP-AR-00658-RAL.
3. Bit 4 may be on only if bit 6 or bit 7 is on.

REQUEST DESCRIPTOR

This request descriptor (RD) is used for communications devices. The RD contains information which details what I/O operations to perform. The RD also provides for the length and location of the data in the Source/Sink Data area (SSD). The fields in the RD are described below:

REQUEST I/O RD FORMAT FOR BSC 3270 Emulation

Request Descriptor	Char(16)
- Command Field	Char(2)
-- First operation (BID) indicator	Bit 0
-- Send Data	Bit 1
-- Unused by 3270 Emulation	Bit 2
-- Reserved (binary zero)	Bit 3
-- Unused by 3270 Emulation	Bit 4-6
-- Receive Data	Bit 7
-- Reserved (binary zero)	Bits 8-15
- Block Received Length	Bin(2)
- Data Area Length--Send or Receive	Bin(4)
- Receive Data Actual Length	Bin(4)
- Unused by 3270 Emulation	Char(4)

RD COMMAND BIT DESCRIPTIONS

First Operation (BID) Indicator--When this bit is '1', the machine will assume the read or write associated with this REQIO is the first operation. This may only be once before EOT is detected or an error will occur.

Send Data--When this bit is '1', the machine will transmit data across the communication link. The machine will automatically handle link level ERP.

Receive Data--This bit indicates that a receive operation is to be performed. This receive operation will only end when data is received, a MODLUD (reset) is executed, or after an error occurs.

Block Received Length--This field is the length of the data block received.

Data Length-Send or Receive--This field is used to specify the available buffer lengths in the SSD as follows:

1. SEND DATA--This field specifies the actual length of the data to be sent by this RD. The valid length is 5 bytes and greater.
2. RECEIVE DATA--This field specifies the actual length available to the machine for receiving data and status for this RD. The maximum block allowed from the link will be 5120 bytes.

Receive Data Actual Length--This field will contain the size of the data block received from the link which is being returned in the SSD.

REQUEST I/O RD FORMAT FOR BSC 3270 EMULATION SYNCHRONOUS REQIO

Request Descriptor	Char(16)
- Command Field	Char(2)
-- Reserved (binary zero)	Bits 0-7
-- Cancel Invite	Bit 8
-- Reserved (binary zero)	Bits 9-15
- Block Received Length	Bin(2)
- Data Area Length--Send or Receive	Bin(4)
- Receive Data Actual Length	Bin(4)
- Unused by 3270 Emulation	Char(4)

Source/Sink Data Contents--(SSD)

Data to be transmitted must have the correct 3270 data stream format as defined in the 3270 Information Display System GA23-0060 document. All buffers to be transmitted must contain 3 bytes in the beginning and 1 byte at the end. The bytes in the beginning must contain the initial characters (STX - CU - DU) while the end byte must contain the trailing sequence character (ETX). At least 1 byte of data is required when sending. It should be noted that the modified data will be left in the SSD area. All data blocks returned from the machine will be as received from the line (in 3270 data stream format).

The receive buffer format is defined as follows:

STX
D A T A
ETB / ETX

The transmit buffer format is defined as follows:

STX		
CU		
DU		
D A T A		- User supplied/machine sent
ETX		- User supplied/machine sent

FEEDBACK RECORD AND ERROR RECOVERY PROCEDURES

The format of the Feedback Record is as follows:

Bytes 00-15	S/S Request Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary	Bin(2)
Bytes 20-21	RD Number	Bin(2)
Bytes 22-23	RIU Segment Count	Bin(2)
Bytes 24-63	Device Dependent Area	Char(40)
Bytes 24-25	Device Dependent Error Code	Char(2)
Bytes 26-27	Hardware Error Code	Char(2)
Bytes 28-35	Timestamp	Char(8)
Bytes 36-37	OU#	Char(2)
Bytes 38-63	Reserved	Char(26)

See the REQIO instruction for a description of the request address and request ID fields.

The error summary field defines the status of the REQIO as generally defined in the REQIO instruction description. The specific values possible for Emulation are itemized in Table 1 of this section.

The RD number is the index of the last RD processed, or the RD in error, if an error is indicated (this will always be 1).

The RIU segment count is unused and is set to binary zeros.

The device dependent area is binary zeros unless the presence of device dependent data is indicated by

the error summary value. (See the error summary value definition in the REQIO instruction. If the device dependent data is present, the fields have the following meaning:

The device dependent error code is a further categorization of the hardware error codes, as shown in Table 1.

The hardware error code is the error code logged in the hardware error log and indicates the specific hardware error encountered. The possible values are shown in Table 1 and further information is present in System 38 Hardware Functional Specification.

The time stamp and OU# are the same values present in the hardware error log entry.

Error summary code E031 located in Table 1 can result if there is no line owner when the failure occurs. If there is a line owner when an error occurs that session will get E021 and all subsequent sessions will get E031. If no session is using the line (no session had been selected or polled at the time of the failure) then all sessions will get an E031.

Table 1 lists the error summary, device dependent error codes, the hardware error log codes, what caused the problem, and the recommended recovery actions.

TABLE 1: BSC ERROR SUMMARY VALUES

ERROR SUMMARY	DEV DEP ERR CODE	HDW ERR CODE	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTIONS	SSR BITS 4567	RD BITS 0123 4567
X'0000'	N/A	N/A	No error condition		XXXX	XXX. X.XX
X'0008'	N/A	N/A	Req I/O cont completion	N/A	N/A	N/A
X'0016'	N/A	N/A	Normal EOT received	Issue a REQIO or deactivate the session.	...X	X
X'0044'	N/A	N/A	S/S data area (as specified in the RD) is too small. RCVD data was truncated.	Correct RD to eliminate truncation. Data has been lost.	...X	X
X'5002'	N/A	N/A	Select rcv'd when REQIO xmit pending for selected session.	This machine is a slave device and has lost contention on the link. Issue a receive REQIOs to accept the received data.	X.X. XX..	
X'5004'	N/A	N/A	RFT processed	Issue REQIO (rcv)	...X	X
X'5005'	N/A	N/A	Limited conversational reply, data was received as a response to data xmitted	Next REQIO must be a rcv operation	..X. .X.. X.X.	
X'5006'	N/A	N/A	Limited conversational reply needed. Read buffer or read modify received previously	Next REQIO should be a Xmit operation. All rcv REQIO's will end with this error summary value	...X	X
X'5016'	N/A	N/A	Previous EOT received	Issue REQIO with RD Bit 0 on or deactivate session	...X	X
X'C009'	N/A	N/A	Part proc'd req term due to reset session	Continue cleanup	XXXX	XXX. X.XX
X'C00A'	N/A	N/A	Unprocessed due to reset session	Continue cleanup	XXXX	XXX. X.XX
X'C00B'	N/A	N/A	IOM Partial Damage	Vary off the CD and LUD to clear this condition. A partial damage event (CD and/or LUD) has also been signaled.	XXXX	XXX. X.XX
X'C041'	N/A	N/A	SSD Destroyed or the SSD is not large enough	Provide a correct SSD, reissue REQIO, and issue a REQIO continue.	..XX	.XX. X.XX
X'C042'	N/A	N/A	Invalid Framing	User program error - the data does not begin with STX or end with ETX.	..X. .X..	

X'C043'	N/A	N/A	Invalid data specif: 1.The data block must be double word aligned. 2.The data block may not span a data segment.	User program error	..XX	.X.. ...X
X'C084'	N/A	N/A	Null SSD PTR	SSD PTR must be a valid data PTR for this Request I/O	..XX	.X.. ...X
X'C085'	N/A	N/A	Invalid Function Field	Function field must follow rules specified.	XXXX	N/A
X'E020'	See Below	See Below	Session failure	Reset, activate session; issue new REQIO if you want to try a new session. Note: ERP actions must be coordinated between the host and tributary.		
X'0007'			Link degradation			
		X'F725'	- Sync not est timeout Data mode		.XXX	.X.. ...X
		X'F765'	- Sync lost timeout		X.XX	XX.. ...X
		X'F805'	- CRC error		X.XX	XX.. ...X
X'0008'			Far end system problems			
		X'9745'	- Cont char Sync Rcvd		X.XX	XX.. ...X
		X'9765'	- Unexpected sync rcvd		.XXX	.XX. X.XX
X'0009'			Using program error			
		X'93A0'	- Invalid Xmit Format		..X.	.X.. X.X.
		X'F660'	- MS buffer overflow		XXXX	XX.. ...X
X'0012'			Protocol errors			
		X'9208'	- EOT abort		XXX.	XX.. X.X.
		X'9388'	- EOT, forward abort		...X	..X. ...X
		X'9578'	- EOT, host aborted read command not satisfied		X.X.	XX.....
		X'9598'	- Remote proto viol limited reply		.XXX	.XX. X.XX
		X'F088'	- NAK to text		X.X.	XX.. X.X.
		X'F108'	- Wrong ACK		X.X.	XX.. X.X.
		X'F288'	- ENQ RCVD to text sent		X.X.	XX.. X.X.
		X'F308'	- Invalid format rcvd		X.XX	XXX. X.XX
		X'F488'	- Enq Rcvd to ACK sent		X..X	X... ...X
X'000A'		X'93F0'	- BSC protocol timeout		.XXX	.XX. X.XX
X'E021'	See Below	See Below	Link failure	Follow action for ND failure event 000E 05 01. The session receiving this error code was the line owner when a link failure occurred.		
X'0007'			Link degradation			
		X'F725'	- Sync not est timeout Data mode		.XXX	.X.. ...X
		X'F765'	- Sync lost timeout		X.XX	XX.. ...X
X'0008'			Far end system problems			
		X'96A5'	- Req to Xmit timeout (RLSD 3.4 seconds)		XXXX	XX.. ...X
		X'9745'	- Cont char Sync Rcvd		X.XX	XX.. ...X
		X'9765'	- Unexpected Sync Rcvd		.XXX	.XX. X.XX

		X'8103'	- Post Event		XXXX	XXX. X.XX
		X'8107'	- Unidentified BSTAT		XXXX	XXX. X.XX
		X'8137'	- Read Sense Time Out		XXXX	XXX. X.XX
		X'81C3'	- IOC/CA Parity error		XXXX	XX.. ...X
		X'8204'	- DTR dropd/inact		XXXX	XX.. ...X
		X'8225'	- PR'd CMD timeout		X.XX	XX.. ...X
		X'8360'	- Line not init		XXXX	XX.. ...X
		X'83C0'	- Invalid CMD seq		..X.	..X..
		X'8401'	- Chl Disc at IOC		XXXX	XX.. ...X
		X'84E2'	- Adapt int req T.O.		XXXX	XX.. ...X
		X'93F0'	- BSC Protocol Timeout		.XXX	.XX. X.XX
		X'E2C4'	- RTS inac/dropped		XXXX	XX.. ...X
		X'F441'	- Data over Chl D		X.XX	XX.. ...X
		X'F481'	- Data under Chl D		..X.	..X..
	X'000B'		Modem Errors			
		X'8224'	- DSR timeout/dropped		XXXX	XX.. ...X
		X'E2E4'	- CTS act before RTS		XXXX	XX.. ...X
		X'E324'	- CTS timeout/dropped		XXXX	XXX. X.XX
	X'000C'		Operator or set up errors			
		X'F4C2'	- Adapt over/Underrun		XXXX	XXX. X.XX
	X'0012'		Protocol errors			
		X'9208'	- EOT abort		XXX.	XX.. X.X.
		X'9388'	- EOT, forward abort		...X	..X. ...X
		X'9598'	- Remote proto viol limited reply		.XXX	.XX. X.XX
		X'F088'	- NAK to text		X.X.	XX.. X.X.
		X'F108'	- Wrong ACK		X.X.	XX.. X.X.
		X'F288'	- ENQ RCVD to text sent		..X.	..X. X.X.
		X'F308'	- Invalid format recvd		X.XX	XXX. X.XX
		X'F488'	- Enq Rcvd to ACK sent		X..X	X... ...X
X'E087'	X'0001'	N/A	Invalid data length The length of the data to be transmitted must be at least 5 bytes in size	User program error	..XX	XX. X.XX
X'E087'	X'0003'	N/A	Invalid command: 1.RD contains invalid CMD bit combination 2.Reserved field violation	User program error	XXXX	XXX. X.XX
X'E087'	X'0012'	N/A	Invalid Cmd sequence User attempted an Xmit operation after receiving a X'5005' FBR code (a receive must be the next operation).	User program error	..X.	..X. X.X.
X'E088'	X'0006'	N/A	Invalid RD combination: Multiple RD's	User program error	.XXX	XX. X.XX

Events Raised by BSC 3270 Emulation

ND Events	Class X'000E'	MSCP upon completion of the vary on processing for the BSC station. Refer to MSCP Section 5.1.2 and Event Section 8.1.2 for details.
. Type 05	Line Failure	
Subtype 01	This event is signaled by MSCP whenever an unrecoverable line error has occurred. The event-related data provides a 2-byte error code, a timestamp, and OU number. The error codes and the error recovery procedures for that error are defined in the Communication Error Recovery Procedures in addition to this event, an error log entry is recorded which contains more detailed information.	
CD Events	Class X'0004'	
. Type 04	CD Contact	
Subtype 01	Successful contact	
LUD Events	Class X'000B'	
. Type 06	LUD Contact	
	This event is signaled by the	
	Subtype 01	Successful contact
	Subtype 02	Unsuccessful contact
		The device has become inoperative - reason code = 0002
	. Type 09	Session Related Events
	Subtype 01	Request I/O Completed.
	Subtype 04	Data received. The LUD is in an activated state and data was received. No event-related data is provided. A REQIO must be issued to receive the data. Only 1 event is signaled per Select-EOT sequence.
	. Type 0A	Response Queue Destroyed
	Subtype 01	

NETWORK DESCRIPTION EXCEPTION CODES

S/S Invalid Object State Exception

For Emulation communications, the MODIFY CD instruction can signal the Invalid Object State exception ('3403'X) for the following new reason:

<u>Command</u>	<u>Reason</u>
Modify CD (Vary on)	ND not in Emulation mode (in an incorrect mode).

S/S Resource Not Available Exception

For communications ND objects, the MODIFY ND instruction can signal the S/S Resource Not Available Exception ('3404'X) for the following state change requests:

<u>Command</u>	<u>Exception Data</u>	
	<u>Generic</u>	<u>Specific</u>
Vary On	'2102'X	Hardware Error Code (activate link failures)
Continue	'2108'X	Error Code--Initialize line failures.
Cancel	'2109'X	None--exception cannot be signaled for this case.

For this case, the status code provided is the same as the status code (HMC error code) provided in the event-related data for the corresponding Line Failure Event as defined in Section 5.5.6.1. Since the exception codes will always be a subset of the event codes, the recovery action should be based on handling of the failure event rather than on the exception.

Configuration Invalid Exception

For BSC communications ND objects, the MODIFY ND instruction can signal Configuration Invalid ('3401'X) for the following reason:

<u>Command</u>	<u>Generic</u>	<u>Specific</u>
Modify ND (Selectable Modes)	'2105'X	ASCII translation error on station address if ASCII mode selected.

Template Value Invalid Exception

For BSC communications ND objects, the CREATE ND instruction can signal Template Value Invalid ('3801'X) for the following reason:

<u>Command</u>	<u>Reason</u>
Create ND	ASCII translation error on station address if ASCII mode selected.

CONTROLLER DESCRIPTION EXCEPTION CODES

S/S Resource Not Available Exception

For Emulation communications CDs, the MODIFY CD instruction can signal the S/S Resource Not Available Exception ('3404'X) for the following state change requests:

<u>Command</u>	<u>Exception Data</u>	
	<u>Generic</u>	<u>Specific</u>
Vary On	'2202'X	None--exception will not be signaled for this case.
Continue	'2208'X	'0801'X--Inoperative Pending status set in the ND object. '0802'X--Cancel Status set in ND object
Cancel	'2209'X	None--exception cannot be signaled for this case.

Template Value Invalid Exception

For BSC communications CD objects, the CREATE CD instruction can signal Template Value Invalid ('3801'X) for the following reason:

<u>Command</u>	<u>Reason</u>
CREATE CD	ASCII translation error on station address if ASCII mode selected in the ND.

LUD EXCEPTION CODES

Invalid Object State

For LUD objects the MODIFY LUD instruction can signal the Invalid Object State exception ('3403'X) for the following new reason:

<u>Command</u>	<u>Reason</u>
Modify LUD (Vary on)	CD not in Emulation mode (in incorrect mode)

S/S Resource Not Available Exception

For Emulation LUDs, the MODIFY LUD instruction can signal the S/S Resource Not Available exception ('3404'X) for the following state change requests:

<u>Command</u>	<u>Exception Data</u>	
	<u>Generic</u>	<u>Specific</u>
Activate Session	'2303'X	Hardware error code--Line failure has occurred. ND failure

event has been signaled.

Continue	'2308'X	'1401'X--Inoperative Pending status set in the CD object. '1402'X--Cancel Status set in CD object
Cancel	'2309'X	None--exception cannot be signaled for this case.
Quiesce Session	'2313'X	'1302'X--Quiesce rejected

Configuration Invalid Exception

For BSC communications LUD objects, the MODIFY LUD instruction can signal Configuration Invalid ('3401'X) for the following reason:

<u>Command</u>	<u>Generic</u>	<u>Specific</u>
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Modify LUD	'2302'X	ASCII translation error on device address if ASCII mode selected in the ND.
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5.8.2.9 Object Creation Data For Supported Devices

This section defines the data needed to create the objects necessary to attach this specific device to the System/38.

ND TEMPLATE FOR BSC 3270 EMULATION DEVICES

<u>Field-Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
ND Type	CD's attached	Char(2)	'00'
Physical addr	Addr of this line	Char(8)	
	- Reserved	Char(4)	'00'X
	- Reserved	Char(2)	'00'X
	- OU number	Char(2)	'0020'X '0021'X '0022'X '0023'X '0060'X '0061'X '0062'X '0063'X

Line definition

- Line discipline	Bit(4)	'0100'B = BSC
- Switched network	Bit(1)	'0'B = Leased
- SNBU feature	Bit(1)	'0'B = Leased
- Data rate select feature	Bit(1)	'0'B = No '1'B = Yes
- Role	Bit(1)	'1'B = Multi-point
- NRZI	Bit(1)	'0'B = No NRZI
- Non clocked modem	Bit(1)	'0'B = No '1'B = Yes
- OEM modem	Bit(1)	'0'B = No '1'B = Yes
- 2/4 wire line leased	Bit(1)	'0'B = 2 Wire '1'B = 4 Wire
- Multipoint physical network	Bit(1)	'0'B = Point to Point '1'B = Multipoint
- Multipoint protocol	Bit(1)	'1'B = Tributary
- Auto dial feature	Bit(1)	'0'B = No
- Auto answer feature	Bit(1)	'0'B = No
- DCE group	Bit(2)	'00'B Nonswitch
- Line speed	Bin(2)	Line rate/100
- Secondary address	Bit(16)	Station poll address

Selectable Modes

- SNBU mode	Bit(1)	'0'B = Leased
- Data rate select	Bit(1)	'0'B = Full '1'B = Half
- Char encoding	Bit(1)	'0'B = EBCDIC '1' = ASCII
- BSC protocol modes	Bit(3)	'010'B = BSC 3270 Emulation
- Switched connect	Bit(2)	'00'B = Non-Switched
- Auto dial mode	Bit(1)	'0'B = N/A
- Auto answer mode	Bit(1)	'0'B = N/A

Communication Subsystem Parameters

- Receive Timeout Timer: value (0-127)

Retry Value Sets

- Retry value length: Specify 18 bytes
- Specify the following Error types and Error Retry Values:

<u>Error Type</u>	<u>Error</u>	<u>Retry Value</u>	<u>Retry Meaning</u>
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X'E001'	value (7-21)	Contention state retry
X'E002'	value (0-21)	Data state retry

CD TEMPLATE FOR BSC 3270 EMULATION DEVICES

<u>Field-Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
CD Type	Attached to an ND	Char(2)	'10'
Unit Type	Generic BSC controller identification	Char(4)	'BSCT' (Multi-Point Trib)
Model Number	Generic BSC controller identification	Char(4)	'0000'
Physical Address	Complete Network address	Char(8)	
	- reserved	Char(4)	binary zero
	- Station address	Char(2)	station poll address
	- OU number of ND	Char(2)	Same as ND
Power Control	Not Used	Char(2)	'0000'X
Station Def	BSC Link	Bit(2)	'01'B
	Link Type	Bit(1)	'0'=nonsw
	Role	Bit(1)	'1'=multi point
	SNBU	Bit(1)	'0'=no
	Rate Select	Bit(1)	'0'=no '1'=yes
Mode Select		Char(2)	
	SNBU	Bit(1)	'0'=leased
	Protocol	Bit(3)	'010'B = BSC 3270 Emulation 3271 controller
Delayed Contact Control		Char(2)	'0000'X
Delay Data	Not Used	Char(4)	
Dial Digits	Phone number	Char(32)	Unused
ND Candidate List	Sysptr(*)	Char(16)	Unused
Specific Characteristics Length		Bin(2)	binary zero
XID Information Area		Char(20)	Unused
Unit Specific Contents		Char(4)	Unused

LUD TEMPLATE FOR BSC 3270 EMULATION DEVICES

<u>Field-Name</u>	<u>Description</u>	<u>Length</u>	<u>Data</u>
LUD Type	LUD attached to a CD	Char(2)	'30'
Device Type	Generic BSC device identification	Char(4)	'BSCT'
Model Number	BSC 3270 Emulation device identification	Char(4)	'0001'
Physical Address	LUDs complete network address	Char(8)	
- Reserved		Char(2)	binary zero
- Device addr	addr used for this LUD	Char(2)	device address
- Station addr	poll addr of CD	Char(2)	Station poll address
- NDs OU#	ND OU#	Char(2)	Same as ND
Session Information	Defines the device's communication capabilities & limitations	Char(32)	
- Session Data	Defines the devices session parameters	Char(4)	
-- Contention Resolution		Bit(1)	'0'B=Slave
Device Specific Area	Defines the unique device parameters	Char(36)	
-- Length of Device Specific Area		Bin(2)	'0020'X
-- Modifiable length of Device Specific Area		Bin(2)	'0010'X
-- Maximum number of input fields (Only used for 3270/5250 emulation)		Bin(2)	The Emulation terminals allowable number of input fields. Valid Values are 126-960.
-- 3270 Buffer format		Bit(2)	'00'B = 3270 Data Stream mode (translate may not be invoked) '01'B = 3270/5250 translation mode '10'B = 3270 Program Interface mode with field entries '11'B = 3270 Program Interface mode without field entries
-- Upper/lower case (Only used for 3270/5250 emulation)		Bit(1)	'0'B = Pass data chars as received '1'B = Convert chars to upper case of cmd.
-- Numeric lock (Only used for 3270/5250 emulation)		Bit(1)	'0'B = Numeric lock not a feature

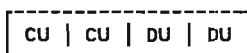
		'1'B = Numeric lock is a feature
-- Reserved	Bit(4)	
-- Reserved	Bit(16)	
-- Language Option (used for 3270 Buffer formats '01'B, '10'B, and '11'B)	Char(3)	where the first 2 chars a 'AG' - Austrian/German 'BL' - Belgium 'BR' - Brazil 'CA' - Canada (French) 'DM' - Denmark 'FA' - French (Azerty) 'FN' - Finland 'FQ' - French (Qwerty) 'IN' - International 'IT' - Italian 'JE' - Japan (English) 'KA' - Japan (Kata) 'NW' - Norwegian 'PR' - Portuguese 'SP' - Spanish 'SS' - Spanish Speaking 'SW' - Swedish 'UK' - United Kingdom 'US' - United States and the last character is 'B' - Basic 'I' - International (for 'KA' only 'B' is valid)
--Device Identification	Char(4)	'3277' Display '3284' Printer '3286' Printer '3288' Printer
-- Reserved	Char(4)	
-- Reserved	Char(16)	

All other LUD fields: Unused for BSC 3270 Emulation.

Note: If 3284, 3286, or 3288 is defined in the device identification field, the 3270 buffer format field must not be set to 3270/5250 translation mode or an error will occur.

5.8.2.10 BSC Emulation Considerations

- For BSC Emulation connections, up to 32 sessions can be active. Each session can have REQIO's pending. When a session has a transmit REQIO pending it is eligible to be polled by the control station. All selects are received whether or not receive REQIO's are pending. If one of the sessions is selected or polled then that session has control of the line until either end sends an End of Transmission (EOT). While one session has control there are no transactions sent on the line for any of the other sessions. When an EOT is sent each session again becomes eligible to be selected or polled.
- Station Address -- Station address is a 2 byte field provided in the ND, CD, and LUD. It is common to all multi-point trib addresses recognized by this line appearance. The address as specified in the ND must have Bit 2 ('20'X) equal to zero. This address can't be a BSC control character. If the line is ASCII, the station address must be translatable to ASCII with the hex '20'X bit off. The address must follow 3270 addressing conventions (see the IBM 3270 Information Display Systems Component Description manual for details).
- Device Address -- Device address is a 2 byte address unique to each LUD connected to a particular CD. The device address can not be a BSC control character and address '7F'X is not valid. If the line is ASCII, the device address must be translatable to ASCII.
- Multi-point Trib Addressing -- The Multi-point trib addresses recognized by System/38 are a composite of the station address and the device address. Each LUD attached to a CD must have a unique device address. The addresses are 4 byte address.
- 4 Byte Multi-point Trib Address



A 4 byte address consists of the control unit address, followed by the device address.

- Polling -- Polling is an invitation by the control station to transmit data from the tributary to the control station. A poll is recognized by Bit 2 ('20'X) being zero in both bytes of control unit address.
- A poll address received which does not match the control unit address specified, will not be responded to.
- A poll address received which matches the control unit address but the device address is for a LUD which is not varied on will be

responded to with Intervention required status for specific polls and EOT for general polls.

- A poll address received which matches the control unit address and the device address is for a LUD which is varied on and in suspend state will be responded to negatively (EOT) assuming device end status was sent.
- A general poll address ('7F'X) received will be supported.
- A poll address received which matches the control unit address and the device address is for a LUD which has a Request I/O transmit pending will cause the transmit to complete.
- If a valid poll is received and an online test requestor function is in progress for the polled address, the OLT function will be initiated.
- For a general poll the machine will send 1 device worth of data. The machine has a scheduling scheme so that different devices use the line (ie. stop one device from monopolizing the link).
- For a general poll the machine will send status or data from all devices that need to transmit. Most hosts though will only take one session's data on a general poll.
- Selection -- Selection is a request by the control station for the selected tributary station to receive data from the control station. A select is recognized by Bit 2 ('20'X) being a one in both bytes of control unit address.
- A select address received which does not match the control unit address specified, will not receive a response.
- A select address received which matches the control unit address but the device address is for a LUD which is not varied on will receive a negative response (RVI indicating status is pending).
- A select address received which matches the control unit address and the device address is for a LUD which is in suspend state will receive a positive acknowledgement (ACK0). A LUD event, unsolicited incoming message (000B 05 04), will also be signaled.
- A select address received which matches the control unit address and the device address is for a LUD which is varied on will cause a positive response to be sent (ACK0).
- Status -- The machine sends status for all operations where the controller would.

- While a LUD is in the varied off state, the machine will send intervention required status to the host for this device (for a general poll, Intervention Required status is never sent).
- When a device (LUD) is activated the machine will send Device End status to the host.
- When the command on the outbound data stream is invalid the machine will send command reject status to the host.
- When an illegal buffer address, incomplete order sequence, incomplete copy command, or an escape was not the first byte received, the machine will send operation check status to the host.
- Data -- As data is received from the link, the blocks are verified for correctness. The machine, prior to acknowledging the data block, will verify that the certain portions meet the 3270 data stream requirements, ie. SBA address is legal, command is correct, WCC is complete, etc. If incorrect an EOT is sent, status is returned to the host on the next poll and the S/38 user is notified via a feedback record.
- Printer -- The following are unique printer differences handled by the machine. When a printer data stream is received, the machine will send a WACK in response to the start printer bit being on in the WCC. If a REQIO has not been issued and the host selects a printer, a WACK will be sent to the host as a response.
- Read Command Retry Counter -- The E002 retry counter (used for data state retries) located in the CD object is also used as the read command NAK retry counter. If a read command is received, the machine sends TTD on the line (using this counter) to keep the line up while the data is prepared to be sent to the host. If this retry counter is exceeded and no data is available to be sent to the host, an EOT will be sent for the session.

5.8.2.11 3270 Emulation IOM Error Log Data

An error log will be written for a line failure. The ID portion of the error log header will identify to which line the error log belongs. The BSC 3270 error logs are the same as BSC Tributary error logs except that only line counters are maintained.

5.8.3 SNA 3270 EMULATION SUPPORT

The emulation of SNA versions of the 3270 Information Display System is supported like any other SNA devices on System/38. Minor extensions have been added to provide the SNA LU2 support necessary for the 3270 family. These changes are documented directly within the SNA device support section of the System/38 MI Architecture. Refer to section 5.2 of this document for these descriptions.

5.9 S/38 WORKSTATION PASSTHRU MANAGEMENT

This section describes the programming considerations and specific support requirements for S/38 WORKSTATION PASSTHRU.

S/38 Workstation PASSTHRU is an integrated APPC application that allows a workstation physically attached (local or remote) to one S/38 to appear as a locally attached workstation on another S/38.

The PASSTHRU management operates on behalf of a source and a target workstation LUD and uses an APPC link to transport information between the systems on which the LUD's reside. The source LUD describes the physical workstation and the target LUD describes a logical or virtual device. Target LUDs must be attached to a virtual controller (CD) i.e. a controller that does not represent any physical hardware.

The general information regarding objects and instructions can be found in the MI Architecture.

5.9.1 PASSTHRU ENVIRONMENTS

PASSTHRU management operates in two environments. One is a simple source-target environment where the source is where the physical workstation resides, and target is where the logical (virtual) workstation resides. The second environment is a more complex source-intermediate-..intermediate-target type and is useful when there is no direct link between source and target or the source and target are both secondaries on the SDLC line connecting systems.

5.9.2 COMMUNICATIONS OBJECTS

OVERVIEW

PASSTHRU management supports all workstation type devices on the S/38. These devices require a Logical Unit Description (LUD) to be created on the system for their support. A LUD is also required on the target system for each workstation, even though there is no physical device present. These LUDs must also be attached to another object called a Controller Description (CD). The CD on the target system is called a virtual CD since it does not represent any physical hardware and is not included in the machine configuration record. PASSTHRU management also interacts with APPC LUDs. These LUDs and CDs, except for the Virtual CD, are described in the Communications Devices, Workstation Controller

and APPC Management sections of this document. The Virtual CD is similar to a Workstation Controller (WSCE), in that it supports the same LUDs and the same commands and instructions are valid. The difference being that the Virtual CD and the attached LUDs do not represent any physical hardware, but instead, simulates the existence of such devices.

5.9.3 PROGRAMMING CONSIDERATIONS

The sections in this document dealing with APPC, Communication Devices and Workstation Controllers, describe the requirements for using these functions. Therefore only the Virtual CD will be discussed here.

PASSTHRU management supports the Virtual CD in such a way so as to make its appearance similar to the Workstation Controller-E (WSCE). The following MI commands are supported.

MODCD:	Vary on/off
	Continue/Cancel
MODLUD	Vary on/Off
	Activate/Deactivate
	Suspend
	Quiesce
	Reset
	Continue/Cancel
	Device Specific Contents
REQIO	Functions - Normal
	MSCP
	Control - Normal
	Continue

Prior to using any of these commands, the user must create the CD and LUDs using the following commands.

CRTCD	Create Controller Description
CRTLUD	Create Logical Unit Description

PASSTHRU Management also supports another MI command used for management the PASSTHRU environment or path.

REQPO Role	- Source (Workstation-APPC Path)
	Target (APPC - Workstation Path)
	Intermediate (APPC-APPC Path)
	Virtual Device

5.9.3.1 PASSTHRU OBJECT CREATION DATA

This section defines the data needed to create the objects necessary to attach a specific Virtual Control Unit. There is a section for each object supported.

9.3.2 CD TEMPLATE VALUES

ELEMENTS CONTAINED IN CD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
CD Definition Data	Char(16)		D	N	D		
-CD Type -Device Type -Model Number -Reserved		Char(2) Char(4) Char(4) Char(6)				CD that is not attached to a ND The Controllers IBM product number The Controllers Model Number	'00' 'PASS' ' ' blanks
Physical Definition Data	Char(16)		D	N	D		
-Physical Address .Reserved .Station's Line address .Operational Unit Number (OU#) -Power Control -Reserved		Char(8) Bin(4) Bin(2) Bin(2) Char(2) Char(6)				Controllers complete network Address These four bytes always zero Station's Line Address: CE will supply OU # of the corresponding ND if a leased line. Not used	'00000000'X '0000'x '00FF'x '0000'X binary zeros
.Station Control Information	Char(32)		D	N	D	This data describes the station and its operating modes	
-XID Information .XID format .Physical Unit Type (PU) .XID Information Length .Station's Name -Block # -Specific ID .PU Characteristics .Reserved .DLC TYPE .Reserved .Maximum length received .Reserved .Frames Limit .Reserved -Station Definition -Reserved -Path Information Unit Type -Reserved		Char(21) Bit(4) Bit(4) Bit(8) Char(4) Bit(12) Bit(20) Bit(8) Char(2) Char(1) Char(1) Bin(2) Char(4) Bit(8) Char(4) Char(1) Char(2) Bin(2) Char(6)				Layout directly from SNA N/A N/A N/A Manufacturing assigned product number User assigned ID used to ensure unique IDs on a line. This indicates no segments are allowed and PU can receive RUs from SSCP. N/A This field specifies the maximum length for the basic transmission SDLC maxout count: number frames that Defines the type of connection and role played by the station SNA transmission header (TH) that station uses	'0000'B '0000'B '00'X '000'x '00'X '0000'X '00'X '00'X '0000'X '00000000'X '0000'X '00000000'X '0000'X '0000'X binary zeros
.Selected Mode Data	Char(16)	Char(16)				N/A	
.Activate Physical Unit Data	Char(16)	Char(16)				N/A	
.Dial Digits	Char(32)					N/A	
.Specific Characteristics	Bin(2)					N/A	'0000'X
.XID Information Area						Work area used for XID data received from terminal	
-Length of XID Data		Bin(2)				N/A	'0000'X

ELEMENTS CONTAINED IN CD TEMPLATE FOLLOW	ELEMENT LENGTH	SUB ELEMENT LENGTH	CRT	MOD	MAT	DESCRIPTION	DATA
.Unit Specific Data Area			D	D	D		
-Length of unit specific area		Bin(2)					'0002'X
-Length of modifiable area		Bin(2)					'0002'X
-Unit Specific Contents Area	Char(2)					RAM Load Option N/A	

LEGEND OF CRT, MOD, AND MAT KEYS

- N - Data fields which are ignored by, not used by, or not applicable to the create, modify, or materialize instructions.
- D - Data to be used in creation or modification, or data that can be materialized.

5.9.3.3 LOGICAL UNIT DESCRIPTION (LUD)

The LUD is used to describe the characteristics of the Logical Unit. The creation data is the same as is described in the WSC Management section of the MI Arch. Vol. IV, except for the following difference. The OU# field must contain '00FF'x.

5.9.3.4 MI Commands

The MI commands MODCD,MODLUD and REQIO are described in the WSC section of this document. Since the Virtual CD does not represent any physical hardware, the functions of most of these commands is only simulate in order to provide a WSC-like appearance to the MI. Information contained in the REQIO template is packaged into a PASSTHRU data record and transmitted, via APPC, to the source system where the REQIO is rebuilt and presented to the appropriate workstation management by the PASSTHRU management support.

5.9.3.5 REQPO

The REQPO instruction is used to activate, deactivate and manipulate a PASSTHRU application below the MI.

Refer to the MI Architecture for details on the REQPO command template.

The REQPO template must contain requester LUD pointer, a system pointer to an MI Response queue for routing the feedback message to the MI user, a Path Identifier field, control field and optional data which is function dependent.

The CONTROL FIELD is used to denote the type of REQPO to the Machine. The field is of two parts, ROLE and FUNCTION. The following values are defined for ROLE:

- '0000'b - TARGET between APPC LUD and virtual workstation LUD.
- '0001'b - INTERMEDIATE between two APPC luds
- '0010'b - SOURCE between workstation and APPC LUD
- '0111'b - VIRTUAL device.

The SYSTEM POINTER to a LUD specifies the requester or primary object for which the operation is being performed.

The MI RESPONSE QUEUE pointer and feedback key provide the mechanism for returning the feedback information to the MI requester.

The PATH-ID is used as the ACCESS KEY to the Path and its resources. This field is provided by the machine and inserted in the template when an initiate Path operation is performed, and must be provided in the template by the MI user on subsequent operations. The only exception to the

latter is for requesters where the ROLE is VIRTUAL device and the LUD SYSTEM POINTER addresses a virtual device.

Optional data formats are described later in this section under the discussions of each type of REQPO.

REQPO (Activate)

Used to initiate the PASSTHRU Management application on behalf of a specific requester LUD. It establishes a Path between the requesting LUD's support and another LUD's support. These Paths can be between a source workstation and an APPC session, between an APPC session and a target workstation attached to a Virtual CD, or between two APPC sessions.

- The variable template data is as follows:

Bytes 0-15: This field must contain an MI System Pointer to a LUD. This LUD is the secondary object in the Path and must be an APPC LUD if the ROLE of the requester is SOURCE (the Path is Workstation to APPC), a workstation LUD attached to a Virtual CD if the ROLE is TARGET (the Path is APPC to Workstation) and an APPC LUD if the ROLE is INTERMEDIATE (Path is APPC to APPC).

Bytes 16-31: This field must contain the APPC conversation identifier associated with the first or only APPC LUD included in the instruction template.

Bytes 32-47: This field must contain the APPC conversation identifier associated with the second APPC LUD included in the instruction template if present.

Bytes 48-49: This field is used to describe any specific device characteristics associated with the requester or secondary LUD. Bit meanings are as follows.

- Bit 0 : Workstation device is a KANJI device. (Source or Target)
- Bit 1 : Workstation device is a 3270 Remote Attach. (Source or Target)
- Bit 14 : Reserved

Bytes 50-51: For a SOURCE Requester this field must contain the length of the data containing information needed to build a REQIO to BIND the source workstation.

Bytes 52-n : For a SOURCE Requester this field must contain the PASSTHRU data record containing information needed to build a REQIO to BIND the source workstation. This record is the first transmission over the APPC link sent by PASSTHRU Management on the target system. The contents of the PASSTHRU data record will be defined later.

REQPO (Send event data)

Used to send event data and have the event signaled at another system. These events can be workstation unsolicited data or Sys/Request 's that are detected at the source system and must be re-signaled at the target system, or certain Sys/Request options that are detected at the target system, but must be processed at the source system.

- The variable template data is as follows:

Bytes 0-3: This field must contain the event identifier.

Bytes 4-5: This field must contain the length of the event related data minus any MI pointers present in the original data.

Bytes 6-7: This field specifies the offset from the start of the template to the event data.

Bytes 8-9: This field is used to specify the length of a compare value (unused by PASSTHRU)

Bytes 10-11: This field specifies the offset from the start of the template to the compare value (Unused by PASSTHRU).

Bytes 12-n : This area will contain the event data.

REQPO (Suspend/Resume)

Used to suspend or resume the Path when the MI user needs to use the source workstation device. Suspend causes PASSTHRU Management to retrieve the current

operation outstanding to the source workstation, and enqueue any other requests from the target until a Resume is processed. A Resume causes the original request to be reissued to the workstation followed by any other requests that may have come in while in the suspended state.

REQPO (Terminate)

Used to terminate the Path.

There is no variable data present for Suspend/Resume.

5.9.3.6 Feedback Record

PASSTHRU management supports the feedback record as described in the MI Architecture Volume III.

The format of the Feedback Record is as follows:

Bytes 00-15	REQPO template Address	Space PTR
Bytes 16-17	Request ID	Bin(2)
Bytes 18-19	Error Summary Field	Bin(2)
Bytes 20-63	unused	Bin(2)

See the REQPO instruction in the MI Architecture for description of the Request Address and Request ID fields.

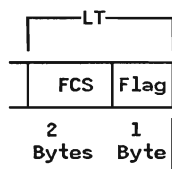
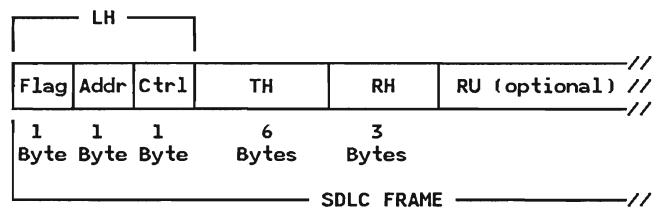
The ERROR SUMMARY field defines the status of the REQPO as generally defined by the REQIO instruction description. The specific values possible for PASSTHRU are itemized in Table 1 which follows.

TABLE I : PASSTHRU FEEDBACK ERROR SUMMARY CODES

ERROR SUMMARY	DEV DEP ERROR	HARDWARE ERROR	PROBABLE CAUSE OR MEANING	RECOMMENDED RECOVERY ACTION
0000	N/A	N/A	Normal completion	No recovery necessary.
4014	N/A	N/A	Command Terminated: -REQPO (Suspend) was issued but Path already suspended. -REQPO (Resume) was issued but Path was not suspended.	1. Reissue in the correct sequence.
4015	N/A	N/A	Command Terminated: -REQPO (Suspend/Resume) issued at target or intermediate system. -REQPO (Send Event) issued at intermediate system.	1. Reissue in the correct environment.
C030	N/A	N/A	Invalid Object Type. - For Intermediates, both LUDs must be for PEER device types - For Source, primary lud must be for Workstation Device, and secondary LUD must be for PEER device. - For Target, primary lud must be for PEER Device , and secondary LUD must be for Virtual workstation.	1. Primary or secondary object pointers not addressing the correct LUD device type. 2. Correct the program to reissue against proper LUD.
C031	N/A	N/A	Object not Online.	Vary the object on.
C022	N/A	N/A	Path non-functional	1. Issue a REQPO to re-initiate.

5.9.3.7 PASSTHRU Management APPC Data Frame

'SDLC I-Frame'



LH = LINK HEADER

* Flag Byte (Hex 7E)

Unique byte that denotes the beginning and end of a frame. The same flag may indicate the end of a frame and the beginning of the next frame.

* Address Byte

Contains the address of the Controller.

* Control Byte

Denotes the type of frame and the receive count (N(r)), and transmit count (N(s)).

TH = TRANSMISSION HEADER

* Address information for FID2 path control PU.T2.

RH = REQUEST HEADER

* Control information needed by transmission control to route messages to NAUs.

RU = REQUEST/RESPONSE UNIT

* Contains the source/sink request (length of RU depends on hardware involved, max of 512).

LT = LINK TRAILER

* Frame check sequence (FCS).

* Flag byte (Hex 7E).

5.9.3.8 PASSTHRU Management RU

5.9.4 STEADY STATE DATA RECORD.

This is the data record that is exchanged by PASSTHRU Management and APPC. It is sent via REQIO messages issued to the APPC Management.

|cccc...ccc|tttttt.....

where:

cccc... - control record
 : llid - GDS header
 : ll - Total length of logical record including this length
 : id - '12A0'x (unmapped conversation application data)
 : ff - Flag to identify record
 : oo - offset to T3 SSD data in logical record
 : ll - length of T3 SSD data (SSD data only)
 : nn - number of T3 RDs present
 : fbr - Workstation IOM feedback record subset sent from Source
 : sss... - T3 REQIO SSR subset (enough to re-create REQIO)
 : kkkk - T3 REQIO key
 tttttt... - T3 RDs and SSD
 : rrr... - T3 REQIO RDs
 : ddd... - T3 SSD data buffer.

• T-3 REQIO SSR Subset

- PASSTHRU management extracts the OPTIONAL POINTER, and the last 16 bytes of the REQIO SSR. The OPTIONAL POINTER field contains information for KANJI/Ideographic work stations, and the last 16 bytes contain the information regarding the type of REQIO. This information is used at the source system to rebuild the REQIO.

• S/S SNA-T3 Request Descriptor(RD)

- See WSC section of this document for information concerning RDs and SSD data.

5.9.5 WORKSTATION EVENT DATA RECORD.

This is the data record that is transmitted between intercept tasks and APPC. It is sent via REQIO messages issued to the APPC iom.

|cccccc|eeee|ddddd.....

where:

cccc... - control record
 : llid - GDS header tation type
 : ll - Total length of logical record including this length
 : id - '12A0'x (unmapped conversation application data)

: ff - Flag to identify record (see include YYPTBUFR)
 eeee - Event id to be signaled on target system.
 dddd - Event data length and event data.

5.9.6 PASSTHRU TERMINATION DATA RECORD.

This is the data record that is generated when a VMC intercept task is terminating. It is sent along the link and contains information related to the cause of termination.

|cccccc|dd.....

where:

cccc... - control record
 : llid - GDS header tation type
 : ll - Total length of logical record including this length
 : id - '12A0'x (unmapped conversation application data) to Target.
 : ff - Flag to identify record see include YYPTBUFR)
 dddd - User data
 : code - Termination reason code.
 : name - Name of system where record originated.
 : devn - Optional name of failing APPC device.

5.9.7 PASSTHRU MANAGEMENT EVENTS

5.9.7.1 REQIO Events

REQIO Complete Event (000B 09 01)

This event indicates that the REQIO asynchronous processing has been completed. It is signaled only if the user requests it.

Request I/O Response Queue Destroyed Event (000B 0A 01).

- Subtype 1 of this event is signaled to indicate that the return queue specified in the REQIO instruction has been destroyed.

5.9.7.2 REQPO Events

REQPO Complete Event (000B 09 05)

This event indicates that the REQPO asynchronous processing has been completed. It is signaled only if the user requests it.

REQPO Response Queue Destroyed Event (000B 0A 01).

- Subtype 1 of this event is signaled to indicate that the return queue specified in the REQPO instruction has been destroyed.

5.9.7.3 LUD Events

PASSTHRU Terminated (000B 0B 02)

This event indicates that the PASSTHRU management is terminating. Reason codes are included in the event data.

- Compare value:
 - System pointer to Requester LUD
- Event Data:
 - System pointer to Requester LUD
 - Data length Bin(2)
 - Termination code Char(4)
 - Vlog Id Char(8)

- System Name Char(8)
- Failing Device Name Char(10)

TABLE II : PASSTHRU TERMINATION CODES

TERM. CODE	PROBABLE CAUSE OR MEANING
0000	Normal termination
000A	Unexpected APPC DETACH received at System xxxxxx on Device yyyyyyy.
0015	APPC operation failed on Device yyyyyy at System xxxxxxxx.
0020	Internal failure occurred at System xxxxxxxx with VLOG Dump Id. zzzzzzzz
0030	Cancel Job received at System xxxxxxxx.

6.0 LOAD DUMP OBJECT MANAGER

Load/Dump (L/D) is the function that allows the user to save permanent objects on a L/D media such as a diskette or tape and retrieve them at a later time. Any of the L/D commands process any of the L/D objects, except that a load of a program object is not allowed (programs may only be create and loaded).

<u>L/D Objects</u> (permanent)		<u>L/D Commands</u>	
• Space Object	(SO)	• Dump	(D)
• Program	(PGM)	• Load	(L)
• Index	(I)	• Create & Load	(C&L)
• Journal Space	(JS)	• - Set User Profile	(SUP)
• Data Space	(DS)	• - Set Context	(SCTX)
• Data Space Index	(DSI)	• - Set Journal	(SJRL)
		• Set Journal Date	(SJD)
		• Set Load/Dump	
		Parameters	(SLDP)
		• Read Object ID	(ROID)

A simplified overview showing the sequence of operations L/D needs is listed below:

1. A Modify Logical Unit Descriptor (MODLUD) (ACTIVATE) session is issued to the L/D device to open the L/D session. The Logical Unit Descriptor (LUD) must be properly initialized to the operational mode (LOAD or DUMP) at this time.
2. A Request Input/Output (REQIO) is issued to L/D. This contains commands and pointers to the objects to be loaded or dumped from the L/D media.
3. L/D checks the REQIO for errors and processes all commands.
4. L/D sends a feedback message to the REQIO RESPONSE QUEUE indicating its completion. For restore (Load or C&L) operations, a good response indicates that all objects in the REQIO have been processed.
5. A MODLUD (DEACTIVATE) session is issued to the L/D device to close the L/D session.

Note: L/D operates only in the EBCDIC mode for tape and diskette, and with 1K sector sizes on the diskette. The user has no control over these values

and any value put in the LUD by the user is ignored.

The Resource Management Attributes within the Process Definition Template will be referenced by the internal L/D operations to adjust the internal priority and performance attributes. This allows the user a degree of control over the allocation of machine resources for the L/D operations. Refer to the INITIATE PROCESS instruction for a description of the Process Definition Template and refer to the Modify LUD (activate session) description later in this section for Load/Dump considerations.

The Load/Dump component in VMC supports data compression/decompression when L/D is operating to a magnetic tape. Compression/decompression will be visible at the MI interface, and it must be managed internally between L/D and the tape IOM. The MI user must indicate via the Request I/O instruction whether each RD is to decompress or not to decompress data on load operations.

6.1 L/D REQUEST I/O (REQIO)

The REQIO instruction is the interface by which the user may load and dump objects. L/D adheres to the REQIO interface protocol, therefore, refer to the REQIO documentation for coding details. Two kinds of REQIO(s) are used to interface with L/D.

- REQIO (CONT): The REQIO (CONT) is used for error processing and indicates that processing of the next REQIO received by L/D should continue where it left off when the recoverable error occurred. This is in accordance with the standard architecture use of REQIO (CONT).
- REQIO: The REQIO contains commands and the needed information to load and dump objects from the system.

The REQIO format for the Source Sink Request (SSR) contains only the standard SSR architected header and L/D Request Descriptors (RD) as defined below. There is no Source Sink Data (SSD) area associated with the SSR.



The context bit indicates if a C&Led object is to be put into a context.

B'0' = The object being created will have its addressability put into the context specified by the previous SCTX command.

B'1' = The object being created will not have its addressability put into any context.

The journaling bit is used to control the journaling of C&Led objects.

B'0' = The object being created will be journaled through the journal port specified by the previous SJRL command. This only occurs if it was journaled when it was dumped.

B'1' = The object being created will not be journaled, even if it was journaled when it was dumped.

The network boundary bits are used to indicate L/D network boundaries. For every beginning boundary there must be a corresponding ending boundary.

B'00' = The object is not part of a L/D network.

B'01' = The object defines the beginning boundary of a L/D network.

B'11' = The object is contained within a L/D network, but is not a L/D network boundary.

B'10' = The object defines the ending boundary of a L/D network.

The data compression/decompression bit is used to indicate that the data associated with the accompanying DUMP OBJECT command is to be compressed per the SNA compression algorithm before being written to the tape media, or that the data associated with the accompanying LOAD OBJECT, CREATE and LOAD OBJECT, or READ OBJECT ID command is to be decompressed per the SNA decompression algorithm before being read back into main storage.

B '0' = No data compression or decompression operation
B '1' = Data compression or decompression is specified as appropriate for the respective dump or load.

Programming Note on Using Data Compression

It is normally expected that use of the data compression/decompression indicators will be consistent for all RD's within each Request I/O except for the first RD. Based on this assumption, the machine implementation (for HDC compression) involves significant overlapping of buffering for the data associated with these RD's in order to optimize performance. If the RD's do not remain consistent for data compression, serious performance reduction will result since the buffer overlapping cannot be used.

Data compression/decompression only impacts the Object Control Field and only has applicability to certain commands in the command field. These are illustrated below.

COMMAND FIELD

The user puts one of the following commands in the command field of the RD.

COMMAND

APPLICABILITY OF DATA COMPRESSION/DECOMPRESSION

LOAD OBJECT	DECOMPRESS (YES/NO)
CREATE & LOAD OBJECT	DECOMPRESS (YES/NO)
DUMP OBJECT	COMPRESS (YES/NO)
SET L/D PARAMETER DATA	NOT APPLICABLE
SET USER PROFILE	NOT APPLICABLE
SET CONTEXT	NOT APPLICABLE
SET JOURNAL	NOT APPLICABLE
SET JOURNAL DATA	NOT APPLICABLE
READ OBJECT ID	DECOMPRESS (YES/NO)

RESERVED FIELD

This field is reserved for use by the machine and any user value put in it will be overlayed.

POINTER FIELD

The pointer is defined as follows:

RD COMMAND

POINTER DEFINITION

DUMP	System pointer to the object in the system to be dumped on the L/D media
LOAD	System pointer to the object in the system that is to be overlaid by the object on the L/D media
CREATE & LOAD	This field is filled in by L/D with a system pointer built after the object has been create and loaded. It points to the object just created (no authority is placed in this pointer). There is no need for the user to initialize this field when building the C&L RD.
SET USER PROFILE	System pointer to the user profile that ownership of the object is given to on all subsequent CREATE & LOAD commands within the same REQIO.
SET CONTEXT	System pointer to the context that addressability to the objects is in for all subsequent CREATE & LOAD commands (that have the context bit of the object control field set to

B'0') within the same REQIO.

SET JOURNAL

System pointer to the journal port to which objects are journaled as a result of subsequent applicable CREATE & LOAD commands within the same REQIO.

OBJECT ID FIELD

object name CHAR (30)
object type CHAR (1)
object subtype CHAR (1) .
user specified ID extension CHAR (32)

The use of the object ID field is dependent on the command used.

DUMP: The object name, type, and subtype must be supplied. The user specified ID extension is optional; however, the entire object ID field is dumped with the object to the L/D media.

LOAD, CREATE & LOAD: For every LOAD and CREATE & LOAD command, the object ID can be between 0-64 bytes. This field is used to find the objects on the L/D media by comparing this object ID field (for a compare length specified in the RD) against the object ID(s) on the L/D media, in the current file, until a match is found.

READ OBJECT ID: This field is filled in by L/D with the 64 byte object ID read from the L/D media.

JOURNAL DATA FIELD

This field is associated only with the SET JOURNAL DATA command. It is used by L/D for the entry specific data while making journal entries.

LOAD/DUMP PARAMETER DATA FIELD

This field is associated only with the SET LOAD/DUMP PARAMETERS command.

The format of the field:

First byte

0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	X

..... Networking bit
..... Reserved (must be zero)

The Networking bit is used to indicate that L/D network boundaries are user defined.

B'0' = Network boundaries are not user defined and must be defined by Load/Dump.

B'1' = Network boundaries are user defined.

Last 79 bytes:

Reserved

6.1.1 L/D COMMANDS

DUMP OBJECT	(D)
LOAD OBJECT	(L)
CREATE & LOAD OBJECT	(C&L)
SET LOAD/DUMP PARAMETERS	(SLDP)
SET USER PROFILE	(SUP)
SET CONTEXT	(SCTX)
SET JOURNAL	(SJRL)
SET JOURNAL DATA	(SJD)
READ OBJECT ID	(ROID)

There are two session types for L/D specified in the LUD operational mode field. If the session type is 'DUMP' only the DUMP, SET L/D PARAMETERS and SET JOURNAL DATA commands are allowed in the REQIO. If the session type is 'LOAD' then any of the L/D commands other than the DUMP command can be in the REQIO. When the ROID command is issued no other command types are allowed in the REQIO.

DUMP COMMAND

DUMP OBJECT - A L/D object is put on the L/D media so that it may be retrieved at a later time.

TO CODE:

- The hex value for the DUMP command is placed in the RD command field.
- A system pointer to the object to be dumped is placed in the pointer field.
- The object ID of the object to be dumped, is placed in the object ID field.

COMMENTS:

- The object need not be addressed by a context.
- Indexes that have pointers in them are not dumped.
- Both observable and nonobservable programs can be dumped.
- Dumping an object does not change the object.

- Objects that are damaged are not dumped.
- Objects that indicate partial damage are not dumped.
- The same object can be dumped any number of times in a REQIO, but the same object cannot be dumped more than once within the same L/D network.
- A suspended object can be dumped.
- The object name, type, and subtype (in the object ID field) must match the object pointed to by the system pointer.
- When dumping a DSI all DS(s) under that DSI must also be dumped in the REQIO. All the DS(s) must precede the associated DSI and be in the same L/D network. See Section on L/D DATA BASE NETWORKS for details.
- Journal Spaces which are empty, attached or detached can be dumped.
- The object in the system is truncated or extended as necessary to fit the version being loaded. The object owner's user profile is charged/credited for the space.
- The size of the object and the object's associated space can be larger after a load than it was when the object was dumped due to internal machine allocations.
- The object 'to be overlayed' on the system can be suspended.
- The object 'to be loaded' from the L/D media can be suspended.
- The same object can be loaded any number of times in a REQIO, but the same object cannot be loaded more than once in the same L/D network. See Section on L/D DATA BASE NETWORKS for details.
- The following attributes of the object to be overlayed are not changed by the load operation:
 - Authority (public and owners)
 - Object Owner's User Profile
 - Context Addressing Object
 - Object Journal Information

LOCK ENFORCEMENT

- Materialization
 - on all objects to be dumped

LOAD COMMAND

LOAD OBJECT - An object is loaded from the L/D media to overlay an object on the system. The current file on the L/D media is searched by comparing the object ID field for the specified compare length with the object ID on the L/D media until a match is found. The object on the L/D media is then loaded onto the system where the object pointer points to.

TO CODE:

- The hex value for the LOAD command is placed in the command field.
- The compare length for the object ID search is placed in the compare length field.
- A system pointer to the object in the system to be overlayed is placed in the pointer field.
- The ID of the object is placed in the object ID field. This field may be initialized with 0-64 bytes of the object ID. The number of bytes initialized should not be less than the compare length in the RD. This field is only used to search the L/D device checking for an object ID match.

COMMENTS:

- A program object can not be loaded (only create and loaded).

- All the other object attributes will be from the object just loaded
- DS and DSI must not have an active cursor over them ('in use').
- When a DS is loaded, all DSIs (even ones that may not be in the REQIO) over that DS must not be 'in use,' damaged or destroyed.
- When a DSI is loaded the 'DS key specification' in the DSI to be overlayed must match the one in the DSI to be loaded and have the same number of records.
- A DSI will not be loaded if any of the DSs under it are create and loaded.
- When loading a DS the 'field descriptor table' of the object on the system must match the one to be loaded before a load can take place.
- If all the DS(s) under a DSI are not loaded before the DSI's in a network, the DSI is not loaded. Intertwined networks on the media can be loaded (see section on L/D DATA BASE NETWORKS for details).
- For a load of a DSI the same DSs must be under both the DSI to be loaded and the DSI to be overlayed. These DSs must also be in the same internal order in the DSI.
- The object that is to be overlayed on the system must have the same name, type, and subtype as the object on the L/D media that is to be loaded.

- The ID on the L/D media is the one that was supplied when the object was dumped by the DUMP OBJECT ID FIELD.
- The object to be overlaid need not be addressed by a context.
- The MI pointers in a space object or any associated space are not resolved by a load and the pointers are made to look like data. It is up to the user to restore these pointers if desired.
- The associated space of an object in the system is replaced by the associated space of the object being loaded.
- An event is generated for any DSI(s) that were invalidated after the data base network is completely restored.
- External links only for DSI(s) and DS(s) are resolved after the DSI is loaded.
- If the object to be overlaid is damaged the load does not take place.
- If the object to be overlaid has partial damage indicated, the load does take place.
- Only versions of objects that are older or equal to the version of the L/D code are loaded (upward compatibility). The version level check is also done on the user exit program in the DSI object.
- An attached Journal Space can only be loaded over if it is attached to a Journal Port that has been damaged or destroyed. Otherwise, if the Journal Space is attached to a functional Journal Port, the load is not allowed.
- A Journal Space cannot be loaded over unless it is on a recoverable boundary.

LOCK ENFORCEMENT

- Object Control
 - on the objects to be loaded
 - on any DSI over a DS to be loaded, even if the DSI is not also loaded

CREATE & LOAD COMMAND

CREATE & LOAD OBJECT - The object to be created is searched for in the current file on the L/D media by comparing the object ID field for the specified compare length until a match is found. Space on the system is allocated and the object on the L/D media is loaded into this newly allocated space. Addressability to the object is placed in the context specified by the previous SET CONTEXT

command if the context bit in the object control field = B'0', and ownership of the object is placed in the user profile specified by the previous SET USER PROFILE command. Journaling of the object is to be started using the journal port specified in the SET JOURNAL command, if the journaling bit in the object control field = B'0', and the object was being journaled at the time it was dumped. Addressability is also placed in the system pointer built by L/D in the pointer field to point to the object created.

TO CODE:

- The hex value for the CREATE & LOAD command is placed in the command field.
- The compare length for the object ID search is placed in the compare length field.
- The context bit in the object control field is set to B'0' or B'1' to indicate if the object is to be addressed by the context specified by the previous SCXT command or not to be addressed by any context.
- The pointer field need not be initialized as L/D builds a system pointer here.
- The ID of the object is placed in the object ID field. This field can be initialized with 0-64 bytes of the object ID. The number of bytes initialized should not be less than the compare length in the RD. This field is only used to search the L/D device checking for an object ID match.

COMMENTS:

- There must not be an object of the same name, type, and subtype in the context specified by the previous SET CONTEXT command if the context bit in the object control field = B'0'.
- There must not be an object with the same JOURNAL ID already being journaled through the journal port specified by the previous SET JOURNAL command if journaling is to be started on the object.
- The ID on the L/D media is the one that was supplied when the object was dumped by the DUMP OBJECT ID FIELD.
- The associated space of the object on the L/D media becomes the associated space of the object created.
- Internal pointers within the object are corrected to reflect address changes.
- External links only for DSI and DS are resolved after the DSI is create and loaded.
- The pointers in a space object or any associated space are not resolved by a create and load and the pointers are made to look like data. It is up to the user to restore these pointers if desired.

- There must be a SET USER PROFILE command before any CREATE & LOAD command(s) within the REQIO.
- If the C&L RD has the context bit in the object control field = B'0', then there must be a SCTX command before this RD within the REQIO.
- If the C&L RD has the context bit in the object control field = B'1', then addressability to the object is not placed in any context.
- Only versions of the object that are older or equal to the version of the L/D code are created (upward compatibility). The version level check is also done on the user exit program in the DSI object.
- The object being created has the identical attributes (Public & Owners authority, Size, etc) as it had when it was dumped except for the user profile and context.
- When a DS or DSI is created, an attempt is made to place it on the same auxiliary storage unit as it was dumped from.
- If all the DS(s) under a DSI are not loaded or create and loaded before the DSIs in a network, the DSI is not created. Intertwined networks on the media can be created (refer to section on L/D data base networks).

LOCK ENFORCEMENT

None

SET USER PROFILE COMMAND

SET USER PROFILE - A SET USER PROFILE command must be issued prior to any CREATE & LOAD commands within a REQIO. The system pointer must point to the user profile that ownership of the object created will be put into. This user profile is also charged for the space needed to create the object. When a SET USER PROFILE command is encountered, all subsequent CREATE & LOAD commands (in that same REQIO) use that user profile until another SET USER PROFILE command is encountered. The SET USER PROFILE command RD is not counted in the 8000 RD limit.

TO CODE:

- The hex value for the SET USER PROFILE command is placed in the command field.
- A system pointer to the desired user profile is placed in the pointer field.
- The object ID field is not used.

COMMENTS:

- The user profile must not be damaged.

LOCK ENFORCEMENT

- Modification
 - on the user profile

SET LOAD/DUMP PARAMETERS COMMAND

SET LOAD/DUMP PARAMETERS - A SET LOAD/DUMP PARAMETERS command is used to communicate information about the REQIO from MI to Load/Dump. When the MI user is defining network boundaries within a REQIO, a SLDP command with the networking bit set to B'1' in the data field must be issued prior to any Load, Dump, or Create & Load commands in the subsequent REQIO. All subsequent Load, Dump, and Create & Load commands must have their network boundary bits set in the Object Control Field to indicate network boundaries and non-network objects. The SET LOAD/DUMP PARAMETERS command RD is not counted in the 8000 RD limit.

TO CODE:

- The hex value for the SET LOAD/DUMP PARAMETER command is placed in the command field.
- The networking bit is set in the Load/Dump Parameter Data Field.

COMMENTS:

- The SET LOAD/DUMP PARAMETERS RD must precede all Dump, Load and Create & Load RDs.
- If a SET LOAD/DUMP PARAMETERS RD has not been encountered before a Dump, Load, or Create & Load command has been encountered, the network boundary bits in the Object Control Field in the Load, Dump, and Create & Load RDs will be ignored. Load/Dump will define network boundaries.
- Only one SET LOAD/DUMP PARAMETERS command per REQIO.
- A SET LOAD/DUMP PARAMETERS command cannot be in a REQIO containing READ OBJECT ID commands.

LOCK ENFORCEMENT

None

SET CONTEXT COMMAND

SET CONTEXT - A SET CONTEXT command must be issued prior to any CREATE & LOAD commands with the context bit in the object control field = B'0' within a REQIO. The system pointer in the pointer field must point to the context that addressability to the object created will be put into. When a SET CONTEXT command is encountered, all subsequent CREATE & LOAD commands (in that same REQIO) with the context bit in the object control field = B'0' use that context

until another SET CONTEXT command is encountered. The SET CONTEXT command RD is not counted in the 8000 RD limit.

TO CODE:

- The hex value for the SET CONTEXT command is placed in the command field.
- A system pointer to the desired context is placed in the pointer field.
- The object ID field is not used.

COMMENTS:

- The context must not be damaged.

LOCK ENFORCEMENT

- Modification
 - on the context

SET JOURNAL COMMAND

SET JOURNAL - A SET JOURNAL can be issued prior to any CREATE & LOAD commands of objects which were being journaled at the time they were dumped. The system pointer must point to the journal port to which the objects are to be journaled. When a SET JOURNAL command is encountered, all subsequent CREATE & LOAD commands involving journaled objects (in that same REQIO) use that journal port until another SET JOURNAL command is encountered. The SET JOURNAL command RD is not counted in the 8000 RD limit.

TO CODE:

- The hex value for the SET JOURNAL command is placed in the command field.
- A system pointer to the desired journal port is placed in the pointer field.
- The object ID field is not used.

COMMENTS:

- Load/Dump is tolerant of damaged and destroyed Journal Ports.

LOCK ENFORCEMENT

- Modification
 - on the journal port

SET JOURNAL DATA COMMAND

SET JOURNAL DATA - A SET JOURNAL DATA command can be issued prior to any L/D command which results in journal entries being made. L/D will use the journal data to build the entry specific portion of journal entries. The length of the journal data to

be used is specified in the compare length field. The SET JOURNAL DATA command RD is not counted in the 8000 RD limit.

TO CODE:

- The hex value for SET JOURNAL DATA is placed in the command field.
- The journal data length is placed in the compare length field.
- The entry specific data is placed in the journal data field.

COMMENTS:

- If no SET JOURNAL DATA command has been encountered before a L/D entry is made on the journal, the entry will be made with zero length entry specific data.

LOCK ENFORCEMENT

None

READ OBJECT ID COMMAND

READ OBJECT ID - The 64 byte object ID of the next object on the L/D media is read and put in the object ID field. This command is provided to get a listing of the objects (ID(s) only) in a file.

TO CODE:

- The hex value for the READ OBJECT ID command is placed in the command field.
- The pointer field is not used.

COMMENTS:

- No other command types may be issued in the same REQIO.
- The ROID command may also be used to position the media at object boundaries. This is useful when portions of the media are unreadable and the user would like to skip over the bad media area and continue loading the remainder of the objects in the file. A way of doing this would be to issue MODLUD (RESET & ACTIVATE) followed by a L/D REQIO with one ROID command in it. Keep issuing the above instructions, crossing volumes if necessary, until a good return code from the REQIO is received. Check the 64-byte returned object ID in the ROID command in case several objects were skipped over due to the bad media area. The media will be logically positioned such that the next LOAD command will read the object identified. Issue a L/D REQIO to continue loading the remainder of the objects in the file.

LOCK ENFORCEMENT

None

6.2 DATA COMPRESSION CONSIDERATIONS

6.2.1 L/D REQUEST I/O EXCEPTIONS

Any error conditions associated with use of the data compression indicators will be diagnosed in the L/D preprocessing routines in that these errors will be signaled via Request I/O exceptions. These will all be handled through exceptions which are already being used for similar types of checks, most notably the template value invalid exception.

6.2.2 ADDITIONAL REQUEST I/O CONSIDERATIONS FOR DATA COMPRESSION

A new bit in the object control field of the L/D RD will be used to indicate whether the object is to be compressed/decompressed, (Data Compression/Decompression bit). This bit (bit 3 of the object control field), when on, will mean the following for each Load/Dump command:

- Dump - Compress the object
- Load - Decompress the object which is to be loaded. All objects which are skipped while searching for this object must have also been compressed when dumped because L/D will decompress any information from the media that must be read to correctly position the media at the object being loaded.
- Create&Load - Decompress the object which is to be create & loaded. All objects which are skipped while searching for this object must have also been compressed when dumped because L/D will decompress any information from the media that must be read to correctly position the media at the object being create & loaded.
- Roid - The next object on the media was compressed when it was dumped.
- Others - The bit will be ignored.

The following table shows when the data compression/decompression bit in a L/D RD is allowed to be set. If the bit is set when it is not allowed, the '3801'X exception will be signaled.

RD Command	72MD	3410/3411	3430	3430 w/ HDC
Dump	NO	YES *	YES *	YES
Load	NO	YES *	YES *	YES
Create & Load	NO	YES *	YES *	YES
ROID	NO	YES *	YES *	YES

SETs	IGNORED	IGNORED	IGNORED	IGNORED
------	---------	---------	---------	---------

* These cases involve software compression or decompression

Since Load/Dump has no control over how the data compression/decompression bit is used in a Load/Dump REQIO, the MI user should be aware that strange results may occur if the bit is used in improper ways.

- An object is compressed at dump but is not decompressed at load.
 - Since L/D will not attempt to decompress the object it is trying to load, the information used to find the object will not be in the expected format, and L/D may not find the object to be loaded.
 - The blocks on tape which make up the object will be an unexpected size, so an invalid block length may occur.
 - L/D may think it is loading the object correctly, but the data in the object may be scrambled.
- A group of objects are dumped not compressed and are followed by an object that is dumped compressed. A load of the compressed object is done and is to be decompressed.
 - If L/D has to skip by the group of uncompressed objects to find the compressed object it will try to treat these objects as compressed. A decompress will be done on each object skipped, although none were compressed. A hardware error can occur. If a hardware error does not occur, the information that L/D uses to find the correct number of blocks to skip to the next object is decompressed into garbage. An invalid descriptor error may occur.
- A group of objects are dumped compressed and are followed by an object that is dumped noncompressed. A load of the noncompressed object is done.
 - If L/D has to skip by the group of compressed objects to find the uncompressed object it will try to treat these objects as uncompressed. No decompress will be done on each object skipped, although it was compressed. The information that L/D uses to find the correct number of blocks to skip to the next object may be scrambled. An invalid descriptor error may occur.
 - The information that L/D is looking at may not have been compressed, so L/D could accidentally load correctly.

6.3 L/D MODIFY LUD

L/D follows standard interface protocol for all of the various MODIFY LUD SESSIONS except for changing sessions from LOAD to DUMP or DUMP to LOAD. A MODLUD (DEACTIVATE) must be issued, the OPERATION MODE byte in the LUD changed, and a MODLUD (ACTIVATE) can then be issued. The MODIFY LUD (RESET) and (SUSPEND) sessions are discussed in this section for clarification purposes only. Any changes to the device specific area (DSA) or L/D indicator field of the LUD are appropriately handled.

MODLUD(RESET) - The MODLUD (RESET) session causes L/D to stop processing the current REQIO (if any) immediately. A feedback record is enqueued to the issuer of the current REQIO with the proper error code and an indicator stating how many RD(s) have been already processed. L/D then flushes the unprocessed REQIO(s) by enqueueing feedback records for each REQIO with the proper error code. The MODLUD (RESET) is then completed. L/D does a cleanup if necessary (see Section on L/D Error Processing) on the RD it was processing when the MODLUD(RESET) request is received. As there is no guarantee of device positioning, it is the users responsibility to correctly position the L/D device after a MODLUD (RESET).

MODLUD(SUSPEND) - The MODLUD(SUSPEND) session is used for interrupting the L/D process at the next convenient point (determined by L/D). The MODLUD(SUSPEND) will make L/D stop processing the current REQIO on a L/D network boundary, unless an error occurs while attempting to get to the boundary. In this case the suspend is aborted. A feedback record for the current REQIO is enqueued to the issuer of that REQIO in all cases. To continue processing, follow the normal L/D error recovery procedure. (Section 6.11).

6.4 L/D FEEDBACK RECORD

Refer to the section on REQUEST I/O in SOURCE/SINK MANAGEMENT INSTRUCTIONS for coding details.

L/D responds with a standard feedback record for every REQIO received. This feedback record contains the status of the associated REQIO and is available to the user when a DEQ is done.

6.5 L/D ERROR PROCESSING

The processing of errors by the user differs depending on the kind of error encountered. There are four types of L/D errors:

- Exceptions
- Severe Errors
- Recoverable Errors
- Other Error Codes

MI Exceptions

Errors that are detected by REQIO result in an EXCEPTION being generated. Because the L/D object handler has not been invoked at this time, no I/O operations have started. To recover from the EXCEPTION, correct the error and reissue the REQIO.

Severe Errors

Most severe L/D errors occur after I/O operations are started. The only recovery is to issue a MODLUD (RESET). REQIO and REQIO (CONT) cannot be processed. These are all nonrecoverable errors.

Recoverable Errors

When a recoverable error occurs, the L/D function returns the feedback record with the proper status and does not process any other REQIO(s) until a MODLUD (RESET) or REQIO (CONT) is issued.

If the user can correct the error (by positioning the L/D media on the next volume/tape or at the beginning of the file) the same REQIO that encountered the error must be returned (with its RDs unmodified) and ahead (higher priority-lower value in the Request Priority Field of the SSR header) of all other REQIO(s) that have been previously issued. A REQIO (CONT) must then be issued.

The REQIO (CONT) is used to tell L/D to finish processing the next REQIO where it left off when the Recoverable error occurred.

If the user cannot correct the recoverable error, a MODLUD (RESET) must be issued.

NOTE: After recovering from one of these errors, it is the user's responsibility to assure that the L/D media is properly positioned to continue processing. Depending on the L/D device, it may be necessary to issue a normal REQIO(CONT) to that device before/after the device is repositioned. Refer to the device documentation for details.

Other Error Codes

'Other' L/D error codes are responses that indicate status of the REQIO.

MODLUD (RESET) After Error

Upon receiving the MODLUD (RESET) after a severe or recoverable error, L/D will cleanup the object it was processing (if necessary), return feedback records for all pending REQIO(s) (unprocessed), and complete the MODLUD (RESET). L/D is then ready to process additional requests. It is the user's responsibility to position the L/D media to the correct starting location after a MODLUD (RESET).

Cleanup

L/D does a cleanup on the object(s) that are being processed when a MODLUD(RESET) is issued.

The cleanup procedure depends on the command being processed.

DUMP	-	No clean up
LOAD	-	If the object is partially loaded at the time of the error, the data portion of the object is left in an unknown state. This object is then damaged, the damage is logged, and a damaged object event is raised. If the object was a DS, the DSIs over that DS will be invalidated. If the object was a DSI and the entire object header was successfully loaded, the object is changed from a damaged state to an invalidated state, and an invalidated index event is signaled. If the partially loaded object is being journaled, a journal entry may appear on the journal although the object may be damaged.
CREATE & LOAD	-	If space for an object is allocated it is destroyed.
SET LOAD/DUMP PARAMETERS	-	No clean up
SET USER PROFILE	-	No clean up
SET CONTEXT	-	No clean up
SET JOURNAL	-	No clean up
SET JOURNAL DATA	-	No clean up
READ OBJECT ID	-	No clean up

Note: Should a MODLUD(RESET) be issued before a L/D network has been completely restored, some of the DSs in the network are left in the damaged state. Using the RD number that had the error in the feedback record, it can be determined if any DSs will be damaged by the rules stated below. Any time

a SJRL, SJD, SUP or SCTX command is encountered while using these rules, ignore that RD and apply the rule to the previous RD.

- All objects prior to the one referenced by the RD in error will have been successfully loaded.
- The object referenced by the RD in error, and all objects after it in the L/D network, may be damaged.

Damaged object events will be raised for the damaged objects. Index invalid events will be raised for any DSIs which were invalidated as a result of the load or the MODLUD(RESET).

EXCEPTION ERROR CODES

The exceptions are generated by REQIO (in addition to REQIO's normal exceptions) when the associated preprocessing L/D errors are detected. The RD number that the error occurred on is in the RD number for exception field of the first RD in the SSR for the exception.

Listed below are exception codes that are the possible reasons for L/D signaling the exception and the commands that could cause the exception.

0A01 Unauthorized For Operation

0A04 Special Authorization Required

1004 Damaged System Object

- Objects associate with L, D, SUP, SCTX & SJRL commands.

1044 Partial System Object Damage

- Objects associated with D commands.

1A01 Invalid Lock State

- Objects associated with L, D, SUP, SCTX & SJRL commands.

1C03 Machine Storage Limit Exceeded

2201 Object Not Found

- Objects associated with L, D, SUP, SCTX, and SJRL commands.

2202 Object Destroyed

- Objects associated with L, D, SUP, SCTX, and SJRL commands.

2204 Object Not Eligible For Operation

- Objects associated with L or D commands.
 - Indexes that have pointers will not be dumped
- DSI or DS with an active cursor 'in use' will not be loaded over

- Objects must be permanent to be dumped or loaded over
- PGM(s) may not be loaded over

2401 Pointer Does Not Exist

- Pointers associated with L, D, SUP, SCTX and SJRL commands.

2402 Pointer Type Invalid

- Pointers associated with L, D, SUP, SCTX and SJRL commands.

2403 Pointer Addressing Invalid Object

- Pointers associated with L, D, SUP, SCTX, and SJRL commands.

2E02 Process Storage Limit Exceeded

3404 Resource not available

- The following table gives the cases where the source/sink resource not available exception is signaled when a MODLUD ACTIVATE L/D SESSION is executed.

Defect Code	Device Specific Return Code	
2303	C4C0	Invalid storage pool specification.

3006 Journal Space not at a recoverable boundary

- L of a journal space which is not at a recoverable boundary.
- L over a journal space which is attached.

3801 Template Value Invalid

- Invalid L/D command.
- Over 8000 RDs in the REQID. (The SLDP, SUP, SCTX, SJRL and SJD RDs are not counted in the 8000 RD limit.)
- No other command types other than SET L/D PARAMETERS and SET JOURNAL DATA allowed with dump command.
- No other command types allowed with ROID command.
- Compare length invalid.
- No SUP command before the first C&L command.
- No SCTX command before a C&L command that had the context bit in the object control field = B'0'.
- Invalid data base network for Load or Dump commands (required DS(s) do not precede DSI(s)).

- Invalid ID (object name, type, or subtype) supplied for object being dumped (does not match the one pointed to by the user supplied pointer).

- Duplicate object encountered within a L/D network. (Dump or Load).

- Invalid network boundary bits

NOTE: Bits 4-7 of the status field for all errors (except 4409 & 4509) below indicate the following:

X'4' = The object being processed will not be damaged by L/D if a MODLUD (RESET) is issued.

X'5' = A cleanup on the object being loaded or created will be done if a MODLUD(RESET) is issued. Refer to the CLEANUP documentation in this section to determine if any objects will be damaged.

SEVERE ERROR CODES

I/O processing of the RDs has started unless otherwise indicated. After each error definition are the possible L/D commands that could cause the error.

<u>Status Field</u>	<u>Definition</u>
X'C4C0' or X'C5C0' commands	Machine storage exceeded-all
X'C4C1' or X'C5C1'	The 'maximum auxiliary storage for permanent objects' field in the object owner's user profile has been exceeded for a LOAD or C&L command--L,C&L
X'C4C2' or X'C5C2'	*Invalid lock (I/O processing has not yet started for D & L commands)--D,L,C&L
X'C5C3'	User profile or context is full of entries for create & load--C&L
X'C5C4'	DUPLICATE OBJECT - object of the same name, type, subtype in the context specified by the SCTX command for this C&L command--C&L
X'C4C5'	DATA BASE NETWORK VIOLATION--L,C&L • A load (L) of a DSI cannot be done if any of the DSs under it were C&Led.

	• All DS(s) under this DSI do not precede the DSI(s) for this network • For a load (L) of a DSI the same DSs must be under both the DSI to be overlayed and the DSI to be loaded. These DSs must also be in the same internal order in the DSI. • The <u>number</u> of key specification records in the DSI to be loaded does not match the DSI on the system.	X'C4C9' X'C4CA' X'C5CB'	Object name, type, & subtype of the object to be loaded does not match the one pointed to by the user supplied pointer--L *DS or DSI has an active cursor 'in use' (I/O processing has not yet started)--L Entry cannot be journaled--L,C&L. The 'Entry not journaled' event will also be signaled. The event will give further information on why L/D could not make the journal entry.
X'C4C6' or X'C5C6'	*Object destroyed--D,L,C&L	X'C5CC'	All objects (DS or DSI) in this network have been loaded but not properly linked together. The "RD number field" in the feedback record contains the RD number of the object in the network that is in error. This is a serious machine problem that occurs when data base objects are damaged but not marked so. --L, C&L.
X'C4C7'	Invalid object--L		
	• For DS, the 'Field descriptor Table' in the DS does not match the one to be loaded • For DSI, the 'DS key specification' in the DSI does not match the one to be loaded • For JS, the sequence numbers and the prefix lengths do not match those in the JS to be loaded	X'C4CD' or X'C5CD' X'C4CE'	*Object was damaged--D,L,C&L Invalid version level The version level of the object or the release it was dumped under is not supported by L/D. Only objects from previous or the current release can be brought onto or offloaded from the system--L,C&L,D.
X'C4C8' or X'C5C8'	A very serious problem has occurred that L/D cannot handle. An unexpected condition occurred in L/D for an unknown reason. It could be a bad object, hardware, machine software, or a JOURNAL failure. Information about this error has been logged. The RD number in the feedback information indicates the RD L/D was working on when the error occurred but that RD may not be the reason for the error. In some cases, where L/D can determine that the reason for the error is a bad object, the object will be marked as damaged and the damaged object event will be signaled. If the error occurred while loading a data base object, the bad object could also be any DS or DSI within the L/D network that contains the current RD. To recover a MODLUD (RESET, DEACTIVATE, & VARY OFF) must be issued for this error. The LUD is marked as partially damaged and the partial damage event has been signaled.	X'C4CF' X'C4D0' X'C4D1' X'C5D2' X'C5D3' X'C4D4'	Unmodified REQIO was not returned while L/D was in a recoverable error mode. The RD's were modified in the SSR. (I/O processing has not yet started)--all commands Object cannot be dumped (I/O processing has not yet started)--D - Index cannot have pointers - Maximum number of Data Space Indexes over a Data Space has been exceeded The reserved field of the first RD was not set to hex 0 for this REQIO. (I/O processing has not yet started)--all commands. Maximum objects through a journal port limit exceeded--C&L Journal ID not unique--C&L Journal Space has become attached--L

X'C5D5'	The object has been loaded but has not been properly fixed up. This is a serious machine problem that occurs when objects are damaged but not marked so.
X'D4FF'	Invalid Load/Dump object descriptor on object to be loaded. Most likely an improper tape or diskette has been mounted or the device is not positioned at the start of a L/D object
X'C4XX' or X'C5XX' or X'D4XX' or X'D5XX' or X'E4XX' or X'E5XX' or X'F4XX' or X'F5XX'	All device errors except EOV/EOT/EOF (there may be additional device information in the device dependent status field). These codes are the device error summary codes ored with '0400'X or '0500'X. Refer to the device documentation for status definition--D,L,C&L,ROID.

*If this error occurs on a RD that has a C&L command, all RDs before this one have been processed. The invalid lock, damaged object, or a destroyed object is not the one associated with the C&L RD, but is either the user profile ownership or the context addressability the object just created is being put in.

RECOVERABLE ERROR CODES

For all recoverable errors, the same REQIO must be reissued along with a REQIO(CONT).

<u>Status Field</u>	<u>Definition</u>
X'8417'	No error occurred on the REQIO, however the EOT was reached while dumping to tape--D
X'C416' or X'C516'	Device end of file (EOF) or tape mark encountered--D,L,C&L,ROID
X'C417' or X'C517'	Device end of volume (EOV) or end of tape (EOT)--D,L,C&L,ROID
X'C4DF'	This REQIO was suspended (on a RD boundary) before all RDs were processed--all commands.
X'E410'	When this error code is encountered while dumping or issuing Read Object ID (ROID) commands to a diskette and the device dependent error code is X'0009', load dump goes into recoverable error mode. The

user may correct the error by using the data interchange REQIO interface to have the device IOM mark an EOF and change to a new diskette. The user then must follow normal load dump error recovery. This is the ONLY case of a recoverable error for an error code of X'E410' on diskette. All other occurrences result in a terminating error.

When this error code is encountered while dumping or issuing Read Object ID (ROID) commands to a tape and the device dependent error code is X'0003', and the hardware error code is not X'B500', load dump goes into recoverable error mode. The user may correct the error by using the data interchange REQIO interface to backspace the tape so that the read/write head is positioned before the bad spot. Then attempt to close the volume by writing a tape mark and any required trailer labels. Since tape marks and trailer labels are physically smaller than most Load/Dump data records, it may be possible to close the volume normally after a write data check. If this is successful, then change to a new tape volume and re-try. To re-try the user then must follow normal load dump error recovery. This is the ONLY case of a recoverable error for an error code of X'E410' on tape. ALL other occurrences result in a terminating error.

OTHER ERROR CODES

<u>Status Field</u>	<u>Definition</u>
X'0400'	Normal REQIO response
X'0408'	Normal REQIO (CONT) response
X'4409' or to MODLUD X'4509'	Partially processed request due (RESET) if bits 4-7 = X'4' the object was not damaged. If bits 4-7 = X'5' the object may have been damaged by cleanup depending on the command being processed.
X'440A'	Unprocessed request due to MODLUD (RESET)
X'4489'	REQIO (CONT) issued when L/D is not in a recoverable error mode

6.6 L/D EVENTS

These events are signaled by L/D when required:

0002 Authorization

0101 Authorization violation
0301 Special Authorization Required

0008 Data Space Index

0301 Data space index invalidated

000B LUD

0901 REQIO feedback record enqueued. This event is signaled only if the Request ID in the SSR so indicates.

000C Machine Resource

0201 Machine auxiliary storage exceeded

0017 Damage

0401 Damaged set in object

0801 Partial damage

001A Journal Port

0301 Entry not journaled

001C Journal Space

0301 Threshold reached

6.7 L/D AUTHORITY

REQIO does all authority checking needed to determine if the proper authority is available for L/D, if it is not an exception and event will be generated.

Authority checking is done by interrogating the adopted user profile of the current invocation and any propagated user profile from any prior invocations. This check is done by "ORing" all the L/D authority attributes in these two user profiles. This checking follows the standard set by the AUTHORIZATION MANAGEMENT section.

The authorization needed to perform a L/D function depends on the command used.

DUMP

(any of the below)

- Unrestricted Dump (Special)
- Restricted Dump (Special) + All object (Special)
- Restricted Dump (Special)
 - + Retrieve
 - + Object management (only if DS object)
 - + Space (if object has associated space)

LOAD

(any of the below)

- Unrestricted Load (Special)
- Restricted Load (Special) + All Object (Special)
- Restricted Load (Special) + Object Control
- Restricted Load (Special) + Ownership

CREATE & LOAD AND READ OBJECT ID

(any of the below)

- Unrestricted Load (Special)
- Restricted Load (Special)

SET USER PROFILE AND SET CONTEXT

(any of the below)

- Unrestricted Load (Special)
- All Object (Special)
- Insert

SET JOURNAL

(any of the below)

- Unrestricted Load (Special)
- All Object (Special)
- Object Management

6.8 L/D DATA BASE NETWORKS

A data base network consists of at least one DATA SPACE INDEX (DSI) and all the DATA SPACES (DS) under the DSI(s). L/D saves the information that links a data base network together when dumping, and restores the data base network links when loading. A L/D network consists of RDs that are grouped together by one of two methods and may contain more than one data base network.

The first method will define L/D networks within the RD list by examining each object and comparing it to other objects in the RD list. A L/D network will start with the first DS in the RD list following a previous L/D network and ending with the RD before the next non-database object or DS which follows a DSI.

The second method will allow the user to explicitly define which groups of objects in the REQIO are to be treated as L/D networks. The network boundary bits in the object control field of the RD will identify all objects included within the L/D network, the beginning, the end, and all non-network objects.

General restrictions on L/D networks, regardless of how they are defined, are listed below.

- There can be other (non network) objects processed in the REQIO.
- Networks are supported by all the L/D commands.
- A DSI cannot be dumped or loaded alone, all of its associated DS(s) must be dumped or loaded along with it.
- When a DSI within a network is loaded, the links to the DS(s) within the same network are connected.

- Any DSI(s) that are over a DS that is being loaded are invalidated if the DSI is not also loaded in the same REQIO.
- An event is generated whenever a DSI is invalidated.
- An active cursor ('in use') may not be over a DS or DSI on a load.
- When a DS is loaded, all DSIs (even ones that may not be in the REQIO) over that DS must not be 'in use,' damaged or destroyed.
- When a DSI is loaded the 'DS key specification' in the DSI to be overlayed must match the one in the DSI to be loaded and have the same number of records.
- A DSI will not be loaded if any of the DSs under it are created and loaded.
- For a load of a DSI the same DSs must be under both the DSI to be loaded and the DSI to be overlayed. These DSs must also be in the same internal order in the DSI.

6.8.1 L/D METHOD OF DEFINING L/D NETWORKS

When the networking bit in a SLDP command is not set on, or no SLDP appears before the first Dump, Load, or C&L command, L/D will implicitly define networks within the RD list. Each object will be examined and its position in the RD list compared with that of other objects in the RD list. A network will start with the first DS in the RD list following a previous network and ending with the RD before the next non-database object or DS which follows a DSI. The networking bits in the Object Control field will be set to reflect the network boundaries defined by L/D. When the REQIO is returned to MI, these bits will still be set. For a recoverable error situation, these bits must remain set when the REQIO is re-issued.

Restrictions on implicitly defined L/D networks are listed below.

- All DS(s) must appear before all associated DSI(s) in a network.
- A L/D network cannot contain duplicate objects.
- Intertwined networks may be Dumped, Loaded, or Create and Loaded as long as there are no non-database objects between them.

Example: ONE Network dumped on media

```

DS-A
DS-B
DSI-1    (over DS-A)
DSI-2    (over DS-A and DS-B)
DSI-3    (over DS-B)

```

TWO intertwined networks could be loaded in a REQIO as below:

```

DS-A
DS-B
DSI-1    (over DS-A)
DSI-3    (over DS-B)

```

L/D will complete the fix up of the two networks (DSI-1, DS-A and DSI-3, DS-B) after DSI-3 is loaded.

EXAMPLE - ORDERING OBJECTS IN THE SSR OF A REQIO

If a list of objects were to be processed that included some networks the following ordering may be used.

Objects to be processed

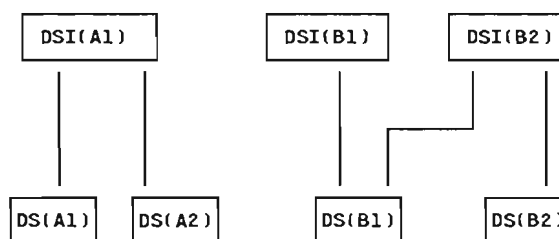
```

Space object
Network A
Data space (non network)
Program
Network B

```

Network A

Network B



A way of ordering in the SSR would be:

```

Space object
DS (A1)
DS (A2)
DSI (A1)
Data space (non network)
Program
DS (B1)
DS (B2)
DSI (B1)
DSI (B2)

```

Network A

Network B

6.8.2 USER METHOD OF DEFINING L/D NETWORKS

By using the networking bit in the SET L/D PARAMETERS RD and the network boundary bits in each Dump, Load, or Create & Load RD, the user may explicitly define which groups of objects are to be treated as a L/D network. The networking bit in the SET L/D PARAMETERS RD should be set by the user to a value of B'1' to indicate that the user is explicitly defining L/D networks. The network boundary bits in the Object Control Field are then

used to identify the network boundaries within the REQIO.

The network boundary bits should be set as follows:

- B'00' = The object is not part of a L/D network (independent).
- B'01' = The object defines the beginning boundary of a L/D network.
- B'11' = The object is contained within a L/D network, but is not a L/D network boundary.
- B'10' = The object defines the ending boundary of a L/D network.

Restrictions on explicitly defined L/D networks are listed below.

- Only one SET L/D PARAMETERS RD allowed per REQIO.
- The SET L/D PARAMETER RD must precede all Dump, Load and C&L RDs.
- For commands other than Dump, Load, or C&L, the Object Control field must be set to B'00'.
- Non-database objects may appear within user defined L/D networks and must have the network boundary bits set as B'11'.
- Any DSIs in the L/D network must follow the DSs they are associated with in the L/D network. DSIs may precede DSs which they are not associated with in the L/D network.

EXAMPLE - ORDERING OBJECTS IN THE SSR OF A REQIO

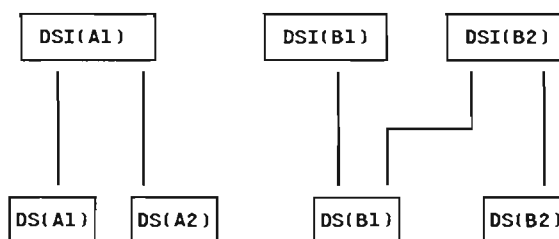
If a list of objects were to be processed that included some networks the following ordering may be used.

Objects to be processed

Space object
Network A
Data space (non network)
Program
Network B

Network A

Network B



The following ordering can be used to make use of the network boundary delimiter bits in each RD:

```

00 Space object
01 DS (A1)
11 DS (A2)      Network A
10 DSI (A1)
00 Data space (non network)
00 Program
01 DS (B1)
11 DSI (B1)      Network B
11 DS (B2)
10 DSI (B2)
  
```

6.9 L/D JOURNAL CONSIDERATIONS

L/D JOURNAL ENTRIES

Journal entries will be made by L/D when operating upon journaled objects. The following sections will list details on how and when these entries are made.

Dump

If a journaled object is being dumped, the 'Object Dumped' journal entry will be made after the object has been successfully dumped. An 'Entry Not Journaled' event will be signaled if the journal entry fails. The dump will complete successfully and L/D will continue processing the REQIO.

Load

If a journaled object is being loaded over, the 'Object Loaded' journal entry will be made after the

load has started and before the object becomes available. If the load fails after the entry is made, the entry will remain on the journal and the object could be marked damaged. Failure to make the journal entry due to the journal port being damaged or destroyed is tolerated. All other failures result in an 'Entry Not Journalled' event signaled and termination of the load session with an unrecoverable error.

Create and Load

C&L of an object which is to be journalled will result in a 'Start Journaling Object' journal entry being made at the time L/D starts journaling the object through the journal port specified in the previous SJRL RD. An 'Object Loaded' journal entry will be made immediately after journaling is started. Both of the entries will be journalled after the C&L is started and before the object is made available. If the C&L fails after journaling is started, L/D will attempt to make an 'Object Destroyed' journal entry during MODLUD (Reset) when the partially created object is destroyed. Failure to make either the 'Start Journaling Object' or the 'Object Loaded' journal entries will result in an 'Entry Not Journalled' event signaled and termination of the load session with an unrecoverable error. If the event indicates that some kind of recovery action can be done on the JOURNAL, the action should be done prior to issuing the MODLUD (Reset). This increases the chances that L/D will be able to successfully make an 'Object Destroyed' journal entry.

L/D OF JOURNAL SPACES

Dumping Unattached Journal Spaces

Journal spaces may be dumped before they have become attached.

Journal spaces may be dumped after they have become detached. All of the journal space will be dumped if it is detached prior to the dump.

Loading Unattached Journal Spaces

After Load or C&L of a JS which was empty at the time it was dumped, the JS will still be empty.

After Load or C&L of a JS, the JS will be in a detached state regardless of its detached or attached state at the time it was dumped. The JS being loaded over must either be empty or match the JS on the media. The checks done to determine a match are:

- 1) The starting sequence numbers must be equal.
- 2) The ending sequence number must be less than or equal to that on the media. This check is done to avoid overlaying a newer version of a JS with a back level copy.
- 3) The prefix lengths must be equal.

Dumping Attached Journal Spaces

Journal spaces may be dumped while they are attached to a journal port. The number of entries to be dumped will be determined at the time L/D starts processing the attached JS. The JOURNAL with which the JS is associated, will become unavailable for a short time while L/D is determining the number of entries to be dumped. Entries that are added to the JS after dump has started will not be dumped. The JS may not be destroyed or be detached while it is being dumped.

Dumping of attached journal spaces can result in some unpredictable situations because the attached JS is being modified while it is being dumped. The main problems occur because the attached JS can change between the point that L/D determines how much is to be dumped and the point at which it is written out onto the media. The JS may increase in size as more entries are added, become hard damaged or become partially damaged.

New entries can be added to the attached JS before the dump has completed. L/D will dump only the entries that were present when it started processing the attached JS. The new entries will not be dumped.

The attached JS could become hard damaged or partially damaged while it is being dumped. If L/D encounters the condition which caused the damage the dump session will fail. If L/D does not encounter the condition which caused the damage the dump will complete successfully. In some cases the JS on the media will be marked as hard or partially damaged. The load of such a JS will complete successfully. A partially damaged JS will remain partially damaged after the load. Since the JS will be detached after the load, the only operation not allowed because of the partial damage will be dump. A JS which is marked hard damaged on the media will be fixed up after the load and will no longer be hard damaged.

Loading Attached Journal Spaces

Load over an attached Journal Space is allowed only when it is attached to a damaged or destroyed Journal Port.

6.10 L/D PERFORMANCE

Below is a list of guidelines that should be followed to achieve maximum performance from L/D.

- It is of extreme importance that the user load objects in the same order as they were dumped on the L/D media. If objects A, B, and C were dumped in order then the objects A, B, and C should be loaded in the same order. This will minimize the number of End of Volume and End of File conditions to be processed.
- When processing objects in a dedicated mode the L/D user can increase throughput by taking advantage of the asynchronous characteristics of

L/D. The greatest throughput gains will occur when many large objects are to be processed on a slow L/D device. The idea is to keep the machine busy while I/O transfer is taking place. For example, if 500 objects are to be processed, have 50 objects in 10 REQIOs. Build the first REQIO and issue it as soon as possible to get the I/O started, then build and issue the second REQIO. Now the user can look at the MI queue to see if the first REQIO has completed, if it hasn't, don't wait for the feedback record but go on to build and issue the third REQIO. Each time after a REQIO is issued, check to see if one of the previous REQIOs has completed successfully but never wait on the queue. By forcing the machine to overlap the setup work with the I/O transfer of data, throughput increases are available to the L/D user.

- If a large number of objects are to be processed, break these objects into several REQIOs instead of one large REQIO.
- A group of objects defined as a network can be processed faster than if the objects are individually defined as independent.
- L/D can process one large object much faster than several smaller objects that would add up to the size of the large object. For example, if it's just as easy to have the needed data in one large space object instead of ten smaller space objects, always keep the data in the big object. The larger the object is, the faster the L/D throughput will be.
- There will be some optimum number of objects to be processed in one REQIO but is not yet defined. Preliminary studies indicate that between 50 and 100 objects per REQIO will give maximum throughput. But if the L/D media is diskettes and the objects are very large, the best throughput would be obtained when the total data transferred per REQIO equals what will fit on one diskette. By doing this, the extra overhead at each EOY (diskette switch) will be minimized.

6.11 L/D EXCHANGE OPERATIONS--PRIMARY AND ALTERNATE DEVICES

When using tape devices, the L/D session can be set up to overlap the processing to one tape drive with the rewind of another tape drive. This is useful when more than one volume of tape is to be processed because the time spent waiting for the tape to rewind is eliminated. Overlapping (exchanging of the L/D REQIOs to different LUDs) may take place on any of the LUDs that are under a given control descriptor.

An example of how the L/D session could be set up to take advantage of overlapping processing and rewind for two drives is listed below.

Assume LUD-1 is associated with drive 1 and LUD-2 is associated with drive 2, both LUDs are in the vary off state and tapes are mounted on both drives:

- 1 Modify LUD-1
 - L/D device indicator = exchangeable L/D device
 - L/D operating mode = dump mode primary
 - VARY on
 - 2 Modify LUD-2
 - L/D device indicator = exchangeable L/D device
 - L/D operating mode = dump mode alternate
 - L/D corresponding primary device address = LUD-1 physical device address
 - VARY on
 - 3 Modify LUD-1
 - activate
(LUD-1 becomes current because it is primary)
 - 4 Modify LUD-2
 - activate
(LUD-2 becomes noncurrent because it is an alternate)
 - 5 REQIO (normal) against LUD-1
 - to write header labels
 DEQ
 - 6 REQIO (L/D) against LUD-1
 - to dump objects
 DEQ
- Assume the end of tape is reached:
- 7 REQIO (Normal) against LUD-1
 - to write trailer labels
 DEQ
 - 8 REQIO (normal) against LUD-1
 - To do rewind/unload with immediate response (rewind of drive 1 starts now)
 DEQ
 - 9 Modify LUD-2
 - L/D exchange status = current & LUD-1 physical device address, LUD-1 address is used because it was the last current LUD
(LUD-2 becomes current, LUD-1 becomes noncurrent)
 - 10 REQIO (Normal) against LUD-2

- To write header labels

DEQ

11 REQIO (L/D) against LUD-2

- To dump objects, this is the same REQIO that encountered the end of volume in step 6. Its RDs must not be modified and its priority must be higher than any other previously issued but not yet DEQ'ed L/D REQIOs.

12 REQIO (L/D) CONTINUE against LUD-2

(Dumping of objects on drive 2 starts while the rewind of drive 1 continues from step 8)

DEQ--the REQIO from this step

13 DEQ--the REQIO from step 11

Assume DUMP completes on drive 2:

14 REQIO (normal) against LUD-2

- to write trailer labels

DEQ

15 REQIO (normal) against LUD-2

- to do rewind/unload

DEQ

16 Modify LUD-1

- L/D exchange status = current and LUD-2 physical device address (LUD-1 becomes current, LUD-2 becomes noncurrent, alternate LUDs must be noncurrent to deactivate while the primary LUD must be current to deactivate)

17 Modify LUD-2

- deactivate
- VARY off

(Alternate LUDs must be deactivated before the primary LUD is deactivated)

18 Modify LUD-1

- deactivate
- VARY off

The previous example shows just one of several ways overlap of processing and rewind can be done. Some of the variations to this are:

1. There can be up to three alternate LUDs tied to a primary LUD.
2. There could be two groups of LUDs, with each group having a primary and alternate LUD. One group could be doing overlap dumping while the other group is doing overlap loading.
3. Alternate LUDs may be added to a group as needed as long as the LUDs were marked as exchangeable devices. This could be useful when it is not known at the start of a session if more than one volume is required.
4. Because normal REQIOs can be issued against noncurrent LUDs, label processing and rewinds could be issued against any of the drives while L/D processing is taking place on the current drive.

Note: L/D REQIOs can only be issued against the current drive.

Extreme care must be used when the exchange MODLUD is issued because the exchange to the new drive will take place at the time it is issued. If L/D were in the middle of processing a REQIO and an exchange took place, some of the objects would be processed on a drive that they may not have intended to be on.

Multiple REQIOs may still be issued to L/D. L/D will always process them on the current drive irregardless of the LUD they were issued against. When any REQIO is DEQ'ed, the LUD pointer in the SSR will be updated by L/D to indicate the LUD where the last object was processed on (the current LUD).

When the normal REQIO to do the rewind/unload is issued and it is not of the immediate response type, then the DEQ should not be done until I/O to the next drive has been started. It would still work but no overlap would take place.

6.12 L/D OBJECT AVAILABILITY

Objects processed by L/D are at times unavailable to the user for reading, modifying, or both. This "unavailable" term is nonrelated to LOCKs, it is a way the machine provides integrity and avoids deadlocks (hanging the system). The unavailability of objects as to the amount of time and to what extent, is dependent on the commands, errors encountered, and LUD states.

COMMANDS

In general, just before I/O processing starts but after the REQIO has been checked for any errors that would result in an exception, objects are made unavailable. After the object has been processed it is made available. As objects are made unavailable on L/D network boundaries (see section on L/D DATA BASE NETWORKS for details), L/D networks with fewer objects to be processed will result in an overall greater availability of these objects.

DUMP - All objects to be dumped are made unavailable for modifying as L/D identifies each network, after processing of the REQIO begins. After each object is dumped (RD is completed) it becomes available again.

LOAD - All objects to be loaded in the L/D network plus all DSIs (even if they are not to be loaded) over any DS's to be loaded, are made unavailable for reading and modifying before I/O processing starts. Objects known not to be in a L/D network become available after each object is loaded (RD is completed). The objects within a data base network (DS's, DSI's, and all DSI's over any of the DS's in this network) become available after the last object in the L/D network is loaded.

C&L - II's, SO's, and PGM's are always available because they were not on the system before the C&L RD and once they are created there is no need to make them unavailable. But when DS's or DSI's are created they are unavailable for reading and modifying until it is known that the DS is not in a network or the network has been completely restored. At this time all DS's and DSI's within the network will become available.

SUP & SCTX - The user profiles and contexts associated with these commands become unavailable for reading and modifying for a very short time, just after the object associated with the C&L command is created. Once ownership and addressability are inserted, the user profiles and context become available. This is done for each C&L RD as it's processed.

SJRL - The journal associated with this command becomes unavailable for modification for a short time, just after the object associated with the C&L command is created. Once the journal port is updated, it will become available. This is done for each C&L RD of a journaled object as it is processed.

SLDP - All objects are available for this command.

SJD - All objects are available for this command.

ROID - All objects are available for this command.

ERRORS ENCOUNTERED

Whenever a severe error or recoverable error is encountered the object associated with the RD that has the error plus any unprocessed objects remain unavailable. In the case of restoring a network and the error occurred on a RD within that network, all objects associated with it are unavailable even though they have been processed. The user now has control and must either correct the recoverable error or issue a MODLUD (RESET). It is of extreme importance that the user's process does not attempt to read or modify any unavailable objects being restored or modify any unavailable objects being saved. If this happens the user will deadlock (hang) his process. A possible recovery to this deadlock would be for some other process to issue a MODLUD (RESET) to L/D. User profiles and contexts are always available when errors are encountered.

LUD STATES

The only MODLUD state where L/D may have objects unavailable and the user has control (possible deadlock) is the ACTIVE state. Once L/D reaches the SUSPEND, RESET, QUIESCE, or DEACTIVE state all objects are available.

ACTIVE - Objects can be unavailable and the user have control when an error condition exists as described under ERRORS ENCOUNTERED.

SUSPEND - When the SUSPEND is completed, all objects under any circumstance that were unavailable are made available. SUSPEND - Once the SUSPEND is successfully completed, work on the REQIO is completed on a L/D network boundary. Therefore, all objects are available. In the case of L/D working on a L/D network and attempting to complete the SUSPEND when an error occurs, L/D aborts the SUSPEND and goes back to an ACTIVE STATE so that the error may be handled. Now objects can be unavailable as described under ERRORS ENCOUNTERED.

RESET - When the RESET is completed all objects under any circumstance that were unavailable are made available.

QUIESCE - Once the QUIESCE is completed successfully, all REQIO(s) issued have also been completed. Therefore, all objects are available. In the case of L/D working on a REQIO and attempting to obtain the QUIESCE but not yet there, L/D aborts the QUIESCE if an error occurs and goes back to an ACTIVE STATE so that the error may be handled. Now objects can be unavailable as described under ERRORS ENCOUNTERED.

DEACTIVATE - After completion of the DEACTIVATE all objects are available. If L/D was in an ACTIVE state and the user issued a DEACTIVATE, an implicit QUIESCE would first be issued to L/D before the DEACTIVATE. Had L/D been in a SUSPENDED

state when the DEACTIVATE was issued, an implicit RESET would first be issued to L/D before the DEACTIVATE.

Note:

- 1 For SO's only, unavailable for reading or modifying does not pertain to all user instruction. Many arithmetic and computational type operations can still be done on a SO even if the SO is unavailable.
- 2 A cursor cannot be activated/deactivated over a DSI while it's being loaded.

6.13 L/D OBJECT STATUS AFTER ABNORMAL SYSTEM TERMINATION

In the event of an abnormal termination, objects

being loaded or created and loaded may be damaged after the system is brought back up. Objects being dumped will not be damaged by L/D should the system go down. Any objects that were damaged by L/D should be destroyed and then a create and load done on them after the system comes up.

All objects which had been successfully loaded at the time of the abnormal system termination will be undamaged.

Some objects which were in the process of being loaded at the time of the abnormal system termination may be damaged.

Data base objects damaged as a result of the abnormal termination during the load will be reported in the Object Recovery List.

DSIs invalidated as a result of the load or the abnormal termination will be reported in the Object Recovery List.

7.0 RESERVED

8.0 SOURCE/SINK EVENTS AND EXCEPTIONS

8.1 S/S EVENTS AND VARIABLE EVENT DATA

The events associated with the Source Sink objects (CD-Event Class 0004, LUD-Event Class 000B, ND-Event Class 000E) are architected to include both fixed and variable event related data. The fixed data includes, for example, a system pointer to the appropriate object. The variable data, however, may be Feature Group dependent and therefore is not defined in architecture.

The format of the variable data is documented in this section for each of the SS events along with a brief explanation of the conditions which cause the event to be signaled. In some cases, other sections of this document must be referenced to find the specific values that are provided by the device type in question when the event is signaled.

Events that are architected to have variable data always include a two-byte length field. If no variable data is provided for a given event, this length field is set to zero.

8.1.1 CONTROLLER DESCRIPTION EVENTS - VARIABLE DATA

CD Contact (CD 0004, Type 04, Subtypes 01, 02, 03)

This event is signaled when the CD VARY ON asynchronous processing is complete. If successful, contact has been established with the controller and we can now attempt to communicate with the devices attached to the controller. If unsuccessful, it means the contact could not be completed and the CD remains in VARY ON PENDING state.

0004 04 01 CD Contact Successful

- System pointer to CD
- System pointer to ND (supplied only when above CD is type 10--otherwise zero)
- Data Length = '0000'X
- Variable Data = None

0004 04 02 CD Contact Unsuccessful

- System pointer to CD
- System pointer to ND (supplied only when above CD is type 10--otherwise zero)
- Data Length = variable (2 to 66 bytes)
- Variable Data = Char(*)
 - Reason Code = Char(2)

- XID data or SSCP-ID or address data from the contacted station (up to 64 bytes) Char(*)

The reason code provides information as to why the VARY ON failed as defined in the chart below. The remaining data is optionally supplied as indicated in the chart also. For CDs which are secondary SDLC stations or BSC stations, this data is the XID which was received and it contains an internal length field which indicates the actual number of bytes present. For CDs which are primary SDLC stations, this data is the 6 byte SSCP-ID field which was received.

Reason	Reason Code	XID Data/SSCP-ID
Dial Operation Unsuccessful (for dial) Note: This reason code (0002) will generally be accompanied by an ND failure event or a CD failure event which identifies the hardware failure which prevented the dialing operation from completing.	0002	No
SDLC XID data or SSCP-ID data does not match CD (on leased, dial)	0003	Yes
ND not in candidate list of this CD (on answer)	0004	Yes
CD not varied on (CD represents a primary leased station)	0005	Yes
BSC first switched operation indicator mismatch (on answer)	0006	Yes
BSC XID Data does not match CD	0007	Yes
BSC - ASCII Translation error on 'This System's XID' (for dial)	0008	Yes
BSC MTAM SIGNON/LOGON invalid data in CD (for leased, answer, dial)	0009	No
BSC MTAM SIGNON/LOGON rejected by host system (for leased, answer, or dial)	000A	No
BSC OR MTAM BSC - Protocol violation at XID (for dial out) BSC MTAM - Protocol violation at SIGNON/LOGON (for leased, answer, or dial out)	000B	Yes
BSC first switched operation indicator mismatch (on dial out)	000C	Yes
BSC or MTAM or LU1 BSC disconnect during XID (on	000D	No

dial out)
 BSC MTAM - disconnect during
 SIGNON/LOGON (for leased,
 answer, or dial out)
 LUL - disconnect before
 ACTPU received from far end
 (on dial out or leased)

Primary SDLC received RD response in reply to XID or SNRM (for leased or dial)	000E	No
Primary SDLC received a station address from far end that does not match CD, but XID does match CD, (on answer) --Station address only (2 bytes) provided as event related data	000F	Yes
Primary SDLC received a station address from far end that does not match CD, but XID does match CD. (for dial) --Station address only (2 bytes provided as event related data	0010	Yes
Primary SDLC station received a negative response to ACT PU (3274 controller)	0011	No
Primary SDLC received excess number of negotiable XID responses as replies to XID commands, far end refuses to assume secondary SDLC role (for leased or dial)	B104	Yes
SDLC received XID with error control vector. (Far end rejects data in S/38 XID - leased or dial only).	B106	Yes
Received XID with invalid data in I-frame, S/38 does not accept data in XID received (for leased or dial)	B108	Yes

0004 04 03 CD Loss of Contact

- System Pointer to CD
- System Pointer to ND (supplied only when above
CD is type 10-- otherwise zero)
- Data Length = '000E'x
- Variable Data = Char (14)

Status Code--Char (2)
 --Value '0001'X = Disconnect ('DISC' or 'RD')
 received from SDLC remote
 --Value '0002'X = Disconnect occurred on BSC link
 or disconnect after SIGNON/LOGON
 on BSC MTAM link

Reserved = Char (12)

CD Failure (CD 0004, Type 05, Subtypes 01, 02, 03, 04)

This event is signaled when a controller is in an inoperative condition and may not be usable. Retry is usually by a VARY OFF and attempt to VARY ON again or for communication devices, use of the error

recovery resource activation mechanism can be used. Subtype 01 is signaled whenever unrecoverable conditions have been encountered by the machine. Whenever this subtype is signaled the Error Recovery Resource Activation field in the CD object will be set to 'inoperative pending status' if the CD is not varied off. This indicator will remain on until a MODCD continue, MODCD cancel, or vary off occurs. Any LUDs attached to this CD which are not varied off may also have their ERP field set to 'inoperative pending status', which again will remain set until a MODLUD continue MODLUD cancel or vary off occurs.

Subtype 02 is signaled by communications support whenever the far end controller is not adhering to the protocol established for the connection. Subtype 03 is signaled when System/38 as the secondary station has received an indication from the primary station that the SSCP to PU session is no longer maintained (eg, DACTPU received).

Subtype 04 is signaled for certain protocol errors or other considerations which are described in MTAM sections of this document.

0004 05 01	CD Failure	(Inoperative)
0004 05 02	CD Failure	(Protocol Violation Detected)
0004 05 03	CD Failure	(SSCP to PU Session Inactive)
0004 05 04	CD Failure	(BSC MTAM Protocol Considerations)

- System pointer to CD
- Data Length - '001E'X
- Variable Data - Char(30)
 - Error Code Char(2)
 - Timestamp Char(8)
(if matching error log entry, otherwise zero)
 - OU Number Char(2)
 - Optional Data (Char(2))
 - Optional System Pointer

For definition of the error codes and optional data consult the appropriate section for Tape, Local Work Station, or Communications controllers.

CD Manual Intervention (CD 0004, Type 06, Subtypes 01, 02, 03, 04)

This event is a request for operator intervention to assist in establishing contact with a controller.

0004 06 01 CD Manual Intervention

- System pointer to CD
- System pointer to ND (CD type 10 switched line cases only--otherwise zero)
- Data Length - '000E'X
- Variable Data - Char(14)
 - Status Code Char(2)
 - Timestamp Char(8)
(if matching error log entry, otherwise binary zero)
 - OU Number Char(2)
 - Optional Data Char(2)

The following status code has been defined for SDLC or BSC switched communications stations. Consult Sections 4 and 5 for definition of other status codes for each device or station type.

Function	Status
Manual Dial Operation	0001
0004 06 02 Unbound Intervention (APPC)	
0004 06 03 Switched Intervention	
0004 06 04 CD Primary Intervention	

These subtypes are further described in MSCP section 5.1.

- System pointer to CD
- Data Length - '0000'X

8.1.2 LOGICAL UNIT DESCRIPTION EVENTS - VARIABLE DATA

Supervisory Services Request (LUD 000B, Type 04, Subtypes 01, 02)

This event is signaled whenever an SNA FM data request is received on the MSCP-LU flow. An unformatted request (eg, SYSTEM REQUEST) causes subtype 01 to be signaled while a formatted request (eg, TEST REQUEST) results in event subtype 02.

- System pointer to LUD
- Data length - variable
- Variable Data - Char(*)

The event variable data is the N-bytes of RU (Request Unit) data as received (up to 80 bytes allowed).

Unsolicited Incoming Messages (LUD 000B, Type 05, Subtypes 01 - 10, 20 - 23)

This event is signaled whenever incoming data is received for which no user supplied buffers have been supplied via a Request I/O instruction. The subtypes are:

- Subtype 01 - Expedited flow
- Subtype 02 - Nonexpedited flow (with or without data)
- Subtype 03 - SSCP to LU unsolicited
- Subtype 04 - BSC line bid received
- Subtype 05 - Expedited flow--secondary
- Subtype 06 - Nonexpedited flow--secondary
- Subtype 07 - BSC MTAM invalid data received (text data received for a suspended stream)
- Subtype 08 - BSC MTAM data stream restarted
- Subtype 09 - BSC MTAM or BSC 3270E incoming data discarded
- Subtype 10 - BSC MTAM device conflict (RFT for wrong device)
- Subtype 20 - APPC conversation incoming data - expedited flow
- Subtype 21 - APPC conversation incoming data - non expedited flow
Note: Subtype 21 is signaled to the process only.
- Subtype 22 - APPC attach request - session not allocated
- Subtype 23 - APPC attach request - maximum sessions exceeded

No variable data is architected for this event (ie, Data Length='0000'X). The incoming message itself must be retrieved by issuing a Request I/O instruction. For subtypes 20, 21, only, the event compare value consists of the LUD system pointer and a 16 byte conversation ID for the conversation flow which received the unsolicited data.

For subtype 22 only, the compare value consists of the LUD pointer and an 8 byte node name. For subtype 23 only, the compare value consists of the LUD pointer and a 32-byte unit of work ID.

All other subtypes use a compare value of the LUD system pointer only.

LUD Contact (LUD 000B, Type 06, Subtypes 01, 02)

This event is signaled when the LUD VARY ON processing is complete. If the device was successfully contacted and ready to go into session subtype 01 is signaled. If unsuccessful due to some unrecoverable situation subtype 02 is signaled and the LUD state is not raised to VARIED ON.

000B 06 01 LUD Contact Successful

- System pointer to LUD
- Reserved Char(16)
- Data Length - '0000'X
- Variable Data - None

000B 06 02 LUD Contact Unsuccessful

- System pointer to LUD

- Reserved Char(16)
- Data Length - '0012'X
- Variable Data - Char(18)
 - Status Code Char(2)
 - Additional Data Char(16)

The following status codes have been defined:

<u>Reason</u>	<u>Status</u>	<u>Additional Data</u>
Unacceptable Response to ACTLU	0001	First 4 bytes of ACTLU response
Unable to Communicate With Device	0002	None
LUD not varied on, or is in inoperative or cancel status (LUD and CD are for a primary station)	0005	None
BIND received for a LUD which is not varied on or is in inoperative or cancel status	0006	None

LUD Operator Intervention (LUD 000B, Type 07, Subtype 01)

This event is signaled when operator intervention is required to make the device operable or when operator intervention has been completed and the device is again operable.

000B 07 01 LUD Operator Intervention Required
000B 07 02 LUD Not Ready to Ready Transition

- System pointer to LUD
- Reserved Char(16)
- Data Length - '000E'X
- Variable Data - Char(14)
 - Status Code Char(2)
 - Timestamp Char(8)
(if matching error log entry, otherwise binary zero)
 - OU Number Char(2)
 - Optional Data Char(2)

LUD Failure (LUD 000B, Type 08, Subtypes 01, 02, 03, 04)

The Device Failure event is signaled whenever a varied on device goes to a state where it can no

longer be used. Subtype 01 is signaled for unrecoverable errors on local devices and BSC communications devices. Whenever this subtype is signaled the Error Recovery Resource Activation field in the LUD object is set to 'inoperative pending status' if the LUD is not varied off. This indicator will remain set until a MODLUD continue or cancel vary off occurs.

Subtype 02 is signaled for communications devices when an SNA LUSTAT request is received on the SSCP-LU session indicating that the device is not available. Subtype 03 is signaled whenever System/38 as the secondary station on a network has received an indication that the primary is no longer maintaining the SSCP to LU session (eg, DACTLU received). Subtype 04 is signaled for APPC devices whenever the device goes to a state where the LU flow is not maintained and recovery activation is required.

000B 08 01 LUD Device Failure
000B 08 02 LUD Device Not Available
000B 08 03 SSCP to LU Session Inactive
000B 08 04 LU to LU Termination

- System pointer to LUD
- Data Length - '000E'X
- Variable Data - Char(14)
 - Error Code Char(2)
 - Timestamp Char(8)
(if matching error log entry, otherwise binary zero)
 - OU Number Char(2)
 - Optional Data Char(2)

The error code values are defined in each device section. For subtype 01 they are hardware error codes corresponding to the error log entries which are made to further identify the hardware error. For subtype 02, the error code field will contain the LUSTAT error code with the timestamp and OU number set to zero.

For subtype 03, the following values have been defined:

<u>Error Code</u>	<u>Remaining Fields</u>
'0001'X = DACTLU received from primary	Binary zero

For subtype 04, the following values have been defined:

<u>Error Code</u>	<u>Remaining Fields</u>
-------------------	-------------------------

'0001'X LU failure - forced termination
 Binary zero

'0002'X BIND failure - invalid session parameters

Session Related Events (LUD 000B, Type 09, Subtypes 01, 02, 03, 04, 05)

000B 09 01 Request I/O Complete (signaled only to the requesting process)

The REQIO complete event is signaled to the requesting process if a flag bit has been set in the SSR when the REQIO is issued.

- System pointer to LUD
- Data Length Variable
- Variable Data Char(2+N)
 - Key Length Char(2)
 - Key (10 to 256 bytes) Char(N)

The variable event data includes a 2-byte length of key and an N-byte key from the SSR.

000B 09 02 LUD Idle Sessions

This event is signaled for an APPC LUD in the active session state attached to a switched controller that does not have "PREBOUND" sessions configured when there are no synchronous conversations, no asynchronous conversations and no bound sessions INB (includes all modenames - USER & RESERVED) and one of the following conditions are present:

- At least one conversation for a User modename (does not include the reserved modename) has been INB and has gone BETB.
- A Deactivate Resource or Return Activate Resources REQIO is issued for all pending (conversation not allocated) Activate Resource REQIO's except for those on the RESERVED modename.

The event related data provides:

- System pointer to LUD
- Data length = '0000'X
- Variable data = None

000B 09 03 LUD No Sessions

This event is signaled for an APPC LUD, in the Active Session State, attached to a switched controller, when all sessions for all modenames (User & Reserved) change from greater than zero bound to zero bound.

The event related data provides:

- System pointer to LUD
- Data length = '0000'X

- Variable data = None

000B 09 04 Incoming Data and no Outstanding Request I/O (signaled only to the process which activated the session)

No variable event related data

000B 09 05 Request Path Operation Complete (signaled only to requesting process)

The REQPO complete event is signaled to the requesting process when a flag has been set in the template used when the REQPO was issued.

Event related data:

- System pointer to LUD SPTR
- Data Length = '0012'X Bin(2)
- Variable Data
 - Key Length = '0010'X Char(2)
 - Key (16 bytes) Char(16)

REQIO or REQPO Response Queue Destroyed (LUD 000B, Type 0A, Subtype 01)

This event is signaled to the requesting process when it is impossible to return a feedback record due to the designated response queue being destroyed.

- System pointer to LUD
- Space pointer to SSR
- Data Length = '0000'X
- Variable Data = None

8.1.3 NETWORK DESCRIPTION EVENTS - VARIABLE DATA

ND Connection Failure (ND 000E, Type 04, Subtypes 01, 02, 03, 04, 05)

This event is signaled when an incoming call is received on a switched line and the station cannot be identified and connected. The following subtypes have been defined:

- 000E 04 01 ND XID Failure (SDLC primary) or secondary or SSCP-ID failure (SDLC secondary LU1)
- 000E 04 02 ND XID Failure (BSC)
- 000E 04 03 ND Disconnect Failure
- 000E 04 04 ND Eligibility Failure (BSC MTAM)
- 000E 04 05 ND Negotiation Failure (APPC)
 - System Pointer to ND

- Data Length - Variable
- Variable Data - Char(*)
 - XID Data (6-64 bytes)

<u>Event Subtype</u>	<u>Signalling Conditions</u>	<u>Event Data</u>
000E 0401 XID failure or SSCP. ID failure (SDLC secondary LUI)	XID or SSCP-ID received from the calling station does not match the XID or SSCP ID data in any CD that is in the VARY ON PENDING state.	For SDLC primary - or secondary. The XID which was received (up to 64 bytes allowed) which has an interval length indicator for how many bytes are actually supplied. For SDLC secondary LUI - The 6 byte SSCP-ID received in the ACTPU from the primary station.
000E 04 02 XID failure (BSC)	The XID from the calling station does not match the XID of any CD within the eligibility list which is in the VARY ON PENDING state and in normal BSC protocol mode (not MTAM mode).	17 bytes including a 2 byte XID length followed by a 15 byte XID field.
000E 04 03 Disconnect failure	No CD's in the eligibility list are in VARY ON PENDING state and in normal BSC protocol mode.	None
	For SDLC secondary, whenever a disconnect occurs on the line prior to receiving of ACTPU from the far end primary station on answer only	
	For BSC, whenever a disconnect was received or protocol violation occurred before XID exchange was completed	
	For APPC,	
		whenever a DISC or RD is received as a response to the XID command under either primary or secondary configuration.
		000E 04 04 Eligibil- ity Failure (MTAM)
		No CD's in the eligibility list are in VARY ON PENDING state and in MTAM protocol mode.
		000E 04 05 XID Negotiation Failure
		APPC - the line connection cannot be established because the remote Primary or Secondary PU sends SNA information out of sequence or XID negotiation fails.
		Up to 66 bytes of data including a 2 byte status code which defines the failure reason, a length field and, in those cases where appropriate, the identification data (XID) received from the failing CPU. There are several failure cases which occur for switched answer only and are described as follows:
		'B104'x--Received excess number of negotiable XID responses as replies to XID commands. Far end refuses to assume secondary SDLC role.
		--Received XID in- cluded as event related data.
		'B106'x--Received XID with error control vector. (Far end does not accept data in S/38 XID).
		Receive data included as event related data.
		'B108'x--Received XID with invalid data in I-Frame. S/38 does not accept data in XID received.
		--XID included as event related data.

ND Line Failure (ND 0D0E, Type 05, Subtype 01, 02)

Subtype 01 indicates that an unrecoverable line error has occurred. Whenever this subtype is signaled the Error Recovery (ERP) Resource Activation field in the ND object is set to 'inoperative pending status' if the ND is not varied off. This indicator will remain set until a MODND continue, cancel or vary off occurs. Any CD's and LUD's attached to this ND which are also not varied off, may have their ERP Mode fields set to 'inoperative pending status' which also will require a CD Vary Off, cancel or continue or LUD Vary Off continue or cancel to clear the condition.

Subtype 02 is signaled for those cases where System/38 is the secondary station and the primary station sends SNA information out of sequence (eg, information frames received prior to ACTPU being processed).

000E 05 01 ND Line Failure (Inoperative)

000E 05 02 ND Failure (Protocol Violation)

- System pointer to ND
- Data Length - '001E'X
- Variable Data - Char(30)
 - Error Code Char(2)
 - Timestamp Char(8)
(if matching error log entry, otherwise binary zero)
 - OU Number Char(2)
 - Optional Data Char(2)
 - System pointer to switched CD, otherwise binary zero

The error codes are defined for each line type in chapter 5.

8.2 S/S EXCEPTIONS AND SPECIFIC EXCEPTION DATA

8.2.1 S/S COMMON EXCEPTION CODES - IMPLEMENTED CHECKS

Several of the return codes for the source/sink exceptions can be raised on behalf of most source/sink objects. This section documents how these return codes are generated and the common hardware specific return codes which are generated.

- S/S configuration Invalid - '3401'X

For the following return codes which indicate

that mismatch of object attributes caused the exception, the actual attribute checking is defined here.

- '1101'X CRTND Backward object supplied is of the wrong S/S object subtype.
- '1102'X CRTND Backward object supplied is already connected to another ND object.
- '1103'X CRTND Duplicate backward pointers supplied.
- '1104'X CRTND Backward object does not have attributes which match this ND.
 - 1 - CD cannot be a switched CD
 - 2 - Role indicator must indicate an opposite role to that of this ND
 - 3 - Line discipline does not match.
- '1105'X CRTND Invalid object supplied in eligibility list.
 - 1 - CD is wrong type.
 - 2 - CD has the wrong line discipline (eg. SDLC instead of BSC)
 - 3 - CD is not switched or switched backup CD.
- '1106'X CRTND Backward objects have duplicate physical address.
- '1107'X CRTND Attempt to create more than the maximum number of ND's for one OU number.
- '1201'X CRTCD Backward or forward object supplied is of the wrong S/S object subtype.
- '1202'X CRTCD Backward object supplied is already connected to another CD object.
- '1203'X CRTCD Duplicate backward pointers supplied.
- '1204'X CRTCD Backward or forward object does not have attributes which match this CD.

Forward Object (ND) Checks:

- 1 - ND cannot be a switched ND.
- 2 - Role indicator must indicate an opposite role to that of this CD.
- 3 - If ND is a primary point to point configuration and it already has one CD attached.
- 4 - If ND role is secondary and one primary CD already is

- connected to that ND (no more than one primary allowed in the network) (Not signaled in Feature Group 1.
- 5 - ND already has the maximum supported number of controllers attached.
 - 6 - Line discipline does not match.

Backward Object (LUD) Checks:

- 1 - LUD Device Type and/or Model is not compatible with CD Unit Type and/or Model.
- '1205'X CRTCD Backward objects have duplicate physical address.
- '1206'X CRTCD Invalid object supplied in ND candidate list.
 - 1 - ND is the wrong subtype (eg, ND type 10 instead of ND type 00)
 - 2 - ND has the wrong line discipline indicated (eg, BSC instead of SDLC)
 - 3 - ND must be a switched line or have switched network backup feature.
 - 4 - If SDLC, then ND must have a role opposite that of this CD.
- '1207'X CRTCD Backward objects supplied have duplicate LU names. (APPC LUD's must have unique LU names.)
- '1208'X CRTCD Backward object address out of range of controller.
 - 1 - 525X LUD with SNA-LU address out of range of WSC CD.
 - 2 - 525X LUD with SNA-LU address out of range of 5294 controller
- '1209'X CRTCD Backward object specific characteristics out of range.
 - 1 - 525X LUD with cable address out of range of WSCE CD.
- '1210'X CRTCD Backward objects supplied have duplicate addresses
 - 1 - Work stations on a controller must have unique cable address, head address assignments.
- '1301'X CRTLUD Forward object supplied is of the wrong S/S object subtype.
- '1304'X CRTLUD Forward Object does not have attributes which match this LUD.
 - 1 - CD Unit Type and/or Model is not is not compatible with LUD Device Type and/or Model.
- '1307'X CRTLUD Forward object supplied (CD) already has an attached LUD with an LU name which is a duplicate of the LU name supplied in this create instruction.
- '1308'X CRTLUD Forward object not compatible with address range.
 - 1 - 525X LUD with SNA-LU address out of range for WSC CD.
 - 2 - 525X LUD with SNA-LU address out of range of 5294 controller
- '1309'X CRTLUD Forward object specific characteristics incompatibility.
 - 1 - 525X LUD with cable address out of range of WSCE CD.
- '1310'X CRTLUD Forward object supplied already has an attached LUD with a duplicate address.
 - 1 - Work stations on a controller must have unique cable address, head address assignments.
- '2101'X MODND Status change attempted with no CD's attached to this ND (non-switched)
- '2103'X MODND Status change attempted to enable dial-in with no valid CD eligibility objects.
- '2104'X MODND Same as '1105'X for CRTND
- '2105'X MODND ASCII Translation - Invalid Address
 - 1 - Secondary Station Address in the ND for BSC Tributary operation is not translatable when Selectable Modes, ASCII Character Encoding, is selected.
- '2201'X MODCD Status change attempted with no LUDs attached to this CD.
- '2202'X MODCD Status change attempted with no valid forward pointer (non-switched CD).
- '2203'X MODCD Dial out errors
 - 1 - Dial attempted with no valid ND candidate list entries.
 - 2 - Improper CD attributes. BSC CD operating in ASCII mode with non-translatable value for 'This System's XID'.
- '2205'X MODCD Same as '1206'X for CRTCD
- '2206'X MODCD ASCII Translation - Invalid Address
 - 1 - Will be signaled for BSC Multipoint Controller support. (FEATURE GROUP X.X)
- '2301'X MODLUD Status change attempted with no valid forward pointer.
- '2302'X MODLUD ASCII Translation -

		not match the ND entry for autocal feature.	Activate Session Failure		due to invalid data in Device Specific Contents field in LUD.
	'nnnn'X	Hardware Error Codes (see individual device sections)		'nnnn'X	Hardware Error Codes (see specific devices)
'2103'X MODND Manual Answer Failure	'nnnn'X	Hardware Error Codes (see individual device sections)	'2306'X MODLUD Power On Failure	'0601'X	Power failure in a device controlled by the SCA
				'0602'X	Power Failure in a device controlled by the power controller.
'2105'X MODND Enable Failure	'nnnn'X	None signaled			
'2108'X MODND Continue Failure	'nnnn'X	Hardware Error Codes	'2307'X MODLUD Power Off Failure	Same codes as above	
'2109'X MODND Cancel Failure	'nnnn'X	None signaled	'2308'X MODLUD Continue Failure	'1401'X	Inoperative Pending status in the CD
				'1402'X	Cancel status in the CD
				'1403'X	Device failure
'2202'X MODCD Vary On Failure	'nnnn'X	Hardware Error Codes (see individual device sections)	'2309'X MODLUD Cancel Failure	'nnnn'X	None signaled
'2204'X MODCD Dial Failure	'0401'X	Dial out failure due to all ND candidates in this CD being unavailable or in use	'2311'X MODLUD Resume Failure	'nnnn'X	Hardware Error Codes (see individual device sections)
	'0402'X	Dial out failure due to Inoperative Pending or Cancel Status	'2312'X MODLUD Suspend Session Failure	'1201'X	Suspend rejected due to indeterminant length outstanding I/O operations
'2206'X MODCD Power On Failure	'0601'X	Power failure in a device controlled by the SCA.		'1203'X	Suspend rejected due to operator intervention condition existing
	'0602'X	Power Failure in a device controlled by the power controller.	'2313'X MODLUD Quiesce Session Failure	'1301'X	Quiesce rejected due to indeterminant length outstanding I/O operation
'2207'X MODCD Power Off Failure	'0601'X	Same as above.		'1302'X	Quiesce rejected due to terminating error condition existing
	'0600'X	Same as above.		'1303'X	Quiesce rejected due to operator intervention condition existing
'2208'X MODCD Continue Failure	'nnnn'X	Hardware Error Codes			
	'0801'X	Inoperative Pending Status			
	'0802'X	Cancel Status			
'2209'X MODCD Cancel Failure	'nnnn'X	None signaled	'3401'X	'yyyy'X	Request I/O Failures (3270 Emulation)
'2300'X MODLUD Non-Status Failure	'nnnn'X	Hardware Error Codes (see individual device sections)	8.2.2 DEVICE SPECIFIC EXCEPTION CODES		
'2302'X MODLUD Vary On Failure	'nnnn'X	Hardware Error Codes (see individual device sections)	Each specific device (or controller or communication line) section of Chapters 3, 4 or 5 will describe additional device specific error codes which they supply for the Resource Not Available ('3404'X) exception.		
'2303'X MODLUD	'0302'X	Activate failure			

9.0 RESERVED

10.0 RESERVED

11.0 SOURCE/SINK RECOVERY

11.1 IPL CLEANUP

When an object is first used after an IPL, the following cleanup is done:

CD, LUD, and ND Objects -- Set the diagnostic active indicator to off, set the partial damage indicator to off, and set the Error Recovery (ERP) Mode field to normal.

CD -- The CD session count and CD active count are set to zero and the status field is set to indicate varied off or powered off depending on the power control field unless the CD was in diagnostic mode in which case the status field is not changed. The switched forward connection pointer is nulled out.

ND -- The ND active count is set to zero and the status field is set to indicate varied off unless the ND was in diagnostic mode in which case the status field is not changed. The switched backward connection pointer is nulled out.

LUD -- The status field is set to indicate power-off state or power-on/vary-off state depending on the value in the power control field unless the LUD was in diagnostic mode in which case the status field is not changed. The load/dump pending indicator is set to none. The switched forward connection pointer is nulled out.

11.2 DAMAGED OBJECTS

If damage related to a S/S object is detected, the object is marked damaged and an exception and an event are signaled. Recovery from damaged objects is to destroy the object (Destroy CD, ND and LUD are tolerant of damage) and recreate it. In some cases, the entire object network must be destroyed before the objects can be recreated and chained properly. If damage occurs while the objects are varied on, the system may have to be IPL'd (to set the object to the varied off state) before some of the undamaged objects in the network can be destroyed.

The S/S instructions set damage as follows:

- Materialize instructions set damage for a bad forward pointer and partial damage for bad switched forward/backward pointers.
- Destroy and create instructions do not set damage.
- Modify instructions set damage for bad forward pointers.
- Request I/O does not set damage.

11.3 PARTIAL DAMAGE

Partial damage is set in a LUD, CD, or ND object when:

- A VMC malfunction is detected.
- A bad switched forward/backward pointer is detected.
- A modify instruction timeout or a synchronous Request I/O instruction timeout occurs due to a VMC or hardware malfunction.

When a VMC malfunction is detected, the object associated with the malfunction is marked partial damaged and a partial damage event is signaled. If the object is a CD, the LUDs attached to the CD are also marked partial damaged and a partial damage event is signaled for each LUD.

When bad switched forward/backward pointers are detected by the materialize or modify instructions, partial damage is set and an event and exception are signaled. If the bad pointer is detected by a modify operation that is tolerant to partial damage, then partial damage is set and the event is signaled but the exception is not signaled and the modify operation is completed.

To ensure the completion of a source sink modify instruction or a synchronous Request I/O instruction, some of the operations performed by the instruction are timed. The timeout value is supplied in the instruction template. The minimum timeout value is 10 seconds. The maximum timeout value is 45 minutes. If a timeout value is not supplied by the user, a default timeout value of 70 seconds is used. If a timeout occurs, a partial damage exception and event are signaled and the object is marked partial damaged.

Partial damage conditions also set the Error Recovery (ERP) Mode field of all affected CD, LUD or ND objects to 'inoperative state'.

11.4 PARTIAL DAMAGE RECOVERY

11.4.1 MODIFY INSTRUCTIONS

Partial damage is reset by returning the object(s) to the varied off state or to the vary on pending state if vary on pending is valid for that object. Returning the objects to varied off state also clears the 'inoperative state' within the Error Recovery (ERP) Mode fields of these objects.

The following modify state change functions are tolerant of partial damage:

- Modify LUD (Status)
 - Reset
 - Deactivate (when issued after a reset)
 - Vary Off
- Modify LUD (Load/Dump Indicator)
 - Load/Dump Exchange Status
- Modify CD (Status)
 - Abandon Connection
 - Vary Off
- Modify ND (Status)
 - Abandon Call
 - Vary Off

These state change functions are tolerant of partial damage and do not signal partial damage exceptions. In these cases, a partial damage event may be signaled but the modify instruction will complete without a partial damage exception being signaled.

If an attempt is made to use state change functions other than those listed when partial damage is set, a partial damage exception is signaled. When recovering from partial damage, all state change rules must be followed (eg, before a CD can be varied off, all LUDs under the CD must be varied off). State change violations result in the same exceptions with or without partial damage set.

When attempting to recover from partial damage, all objects involved should be placed in the vary off state before attempting to retry the operation. For example, a modify LUD partial damage failure for a TP device could be caused by a station IOM

malfunction. The station IOM is created when the CD is varied on. Therefore, the LUD could be varied off to reset the partial damage but would fail on the vary on unless the CD is also varied off and varied on again to recreate the station IOM.

11.4.2 REQUEST I/O TIMEOUT CONSIDERATIONS

Section 11.3 describes the conditions under which VMC or hardware malfunctions which occur are signaled as partial damage situations through the partial damage event or through the modify instruction processing or through synchronous Request I/O processing, as a partial damage exception. Since the same malfunctions might occur due to an asynchronous Request I/O instruction operation and since this cannot be signaled as an exception on the Request I/O instruction, the only method of detection of these malfunctions is by activating the Dequeue wait timeout so that the user's process will not wait an indefinite amount of time for the feedback record to be posted. It is the user's responsibility to establish the Dequeue timeout or to provide any equivalent means of preventing indefinite waits, if required. Establishing of the timeout value must be done by considering the particular source/sink device, its command characteristics, and other factors such as whether or not system operator intervention or other human actions are part of the timing interval.

The machine does not recognize any partial damage conditions if Request I/O timeout occurs on the Dequeue of the feedback record. The user must determine what the recovery action is to be in the event of such a timeout.

